STAR

SEMIMONTHLY

NASA SP-7
Orig.

MARCH 23, 1966

VOLUME 4 • NUMBER 6

N66-15201—N66-16165

DOCUMENTS
APR 18 1966
Duke University Library

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Purchase of *STAR*

The semimonthly issues and the cumulative index issues are available postpaid on subscription and in single copy from the Superintendent of Documents, United States Government Printing Office, Washington, D.C., 20402, United States of America.

Semimonthly issues. Annual subscription rate: $33.00, domestic; $42.00, foreign. Price per single copy: $2.25, domestic; 25¢ extra for foreign mailing.

Cumulative index issues. Annual subscription rate: $30.00, domestic; $35.00, foreign. Price per single copy varies according to the number of pages.

Domestic subscription rates apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.

Foreign subscription rates apply to Argentina, Brazil, British and French Guiana, Surinam, British Honduras, and all other countries throughout the world.

Payment should be by check, money order, or document coupons, and must accompany order. Remittances from foreign countries should be made by international money order, or draft on an American bank, payable to the Superintendent of Documents, or by UNESCO book coupons.

Published by:
United States Government
National Aeronautics and Space Administration
Scientific and Technical Information Division

Scientific and Technical Aerospace Reports, Volume 4, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Documentation Incorporated.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget January 9, 1965

Introduction

Scientific and Technical Aerospace Reports (STAR) is a comprehensive abstracting and indexing journal covering worldwide report literature on the science and technology of space and aeronautics. It is published twice each month.

Major areas covered in *STAR* are:

- Scientific and technical reports of the National Aeronautics and Space Administration and its contractors.
- Scientific and technical reports of government agencies, universities, and research organizations throughout the world.

The first section of *STAR*, arranged in 34 categories, contains abstracts and bibliographic citations (see p. vi). A second section consists of five indexes: subject, corporate source, author, report/accession number, and accession/report number. Separate cumulative indexes are published quarterly, except for the fourth quarter, which is an annual index. Cumulative indexes also contain a contract number index.

Readers are encouraged to examine the abstracts in each category of interest. If time is short, and when interest is concentrated in specific areas, readers may wish instead to scan source, author, and subject indexes. A more thorough coverage of a subject field may often be achieved by detailed examination of the subject listings, especially as they are cross-indexed in the quarterly indexes.

NASA documents (identified with an asterisk), as well as *STAR* itself, are available without charge to:

1. NASA Offices, Centers, contractors, subcontractors, grantees, and consultants.
2. Other U.S. Government agencies and their contractors.
3. Libraries in the United States that maintain collections of NASA documents for public reference.
4. Other organizations in the United States having a need for NASA documents in work related to the aerospace program.
5. Foreign government or academic (university) organizations that have established reciprocal arrangements for the exchange of publications with NASA, that have current agreements for scientific and technical cooperative activities with NASA, or that have agreements with NASA to maintain depositories of NASA documents for public use.

NASA documents identified with the symbol # have been placed on microfiche and are available in that form without charge to the organizations listed above.

Foreign non-copyrighted documents will be provided to U.S. Government Agencies and their contractors. AGARD reports that are not commercially available will also be provided by NASA to the domestic organizations listed above.

Other non-NASA documents are provided by NASA without charge only to NASA Offices, Centers, contractors, subcontractors, grantees, and consultants.

How to Request Listed Documents

If you are registered with NASA, send a completed *Document Request* (Facility Form 492) to:

NASA Scientific and Technical Information Facility
P.O. Box 33
College Park, Maryland, 20740

If you are eligible to receive documents without charge (see previous page) but are not registered with NASA, request *Registration Form—Technical Publications* (NASA Form 439) from:

Scientific and Technical Information Facility
Attention: NASA Representative
P.O. Box 33
College Park, Maryland, 20740

How the Public May Obtain Listed Documents

For reference purposes, NASA documents listed in *STAR* may be consulted at one of the organizations listed on the inside back cover. Commercial publications listed in *STAR* may usually be consulted in libraries or purchased from publishers or booksellers.

The public may purchase NASA documents and non-copyrighted foreign documents listed in *STAR* from either of two sales agencies, specifically identified in the abstract section:

- Clearinghouse for Federal Scientific and Technical Information (CFSTI), Port Royal Road, Springfield, Virginia, 22151
- Superintendent of Documents (GPO), U.S. Government Printing Office, Washington, D.C., 20402

Documents available from the Clearinghouse for Federal Scientific and Technical Information are sold in hard-copy and microfiche form. If printed hard-copy is not available, a facsimile copy is provided. The symbols "HC" and "MF" are used in the abstract section to designate the copy available: "HC" for full-size or facsimile; "MF" for microfiche. The price is also given. Following the availability information in the citation of each NASA-supported document is a code, e.g., CSCL 25A, indicating the subject category assigned to that document from the *COSATI Subject Category List* (first ed., December, 1964) published by the Committee on Scientific and Technical Information of the Federal Council for Science and Technology.

The public may request non-NASA documents by writing to the source, or other information systems. Identification other than the NASA accession number (N66-12345) should always be provided when requesting such a document from its source.

Abstracts of Journal Articles

By arrangement between NASA and the American Institute of Aeronautics and Astronautics, the AIAA publication *International Aerospace Abstracts* is issued in coordination with *STAR*. Each journal appears on alternate weeks. *IAA* uses identical subject categories with those in *STAR*, and publishes similar indexes. *IAA's* worldwide coverage of books and scientific and trade journals complements *STAR's* worldwide report coverage. The two publications thus provide comprehensive access to current literature on aerospace science and technology.

Organizations having a NASA contract may obtain *IAA* by writing NASA, Code USS-A, Washington, D.C., 20546. Others should direct inquiries to the American Institute of Aeronautics and Astronautics, 750 Third Avenue, New York, N.Y., 10017.

Table of Contents

Volume 4 Number 6 / March 23, 1966

Abstracts in the journal are grouped under the following categories: PAGE

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. 817

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. 821

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. 823

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. 829

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. 842

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. 846

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. 854

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. 858

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. 861

10 ELECTRONICS
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. **868**

11 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. . . . **869**

12 FLUID MECHANICS
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. **874**

13 GEOPHYSICS
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. **878**

14 INSTRUMENTATION AND PHOTOGRAPHY
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. **889**

15 MACHINE ELEMENTS AND PROCESSES
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, reliability; drafting; and materials fabrication, handling, and inspection. **894**

16 MASERS
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. **899**

17 MATERIALS, METALLIC
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. **900**

18 MATERIALS, NONMETALLIC
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. **904**

19 MATHEMATICS
Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers. **907**

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. **911**

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. **913**

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. **914**

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 918

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 922

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 928

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 932

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 938

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 939

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear. 943

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 946

31 SPACE VEHICLES
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. 956

32 STRUCTURAL MECHANICS
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. 960

33 THERMODYNAMICS AND COMBUSTION
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. 968

34 GENERAL
Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents. 973

SUBJECT INDEX I-1

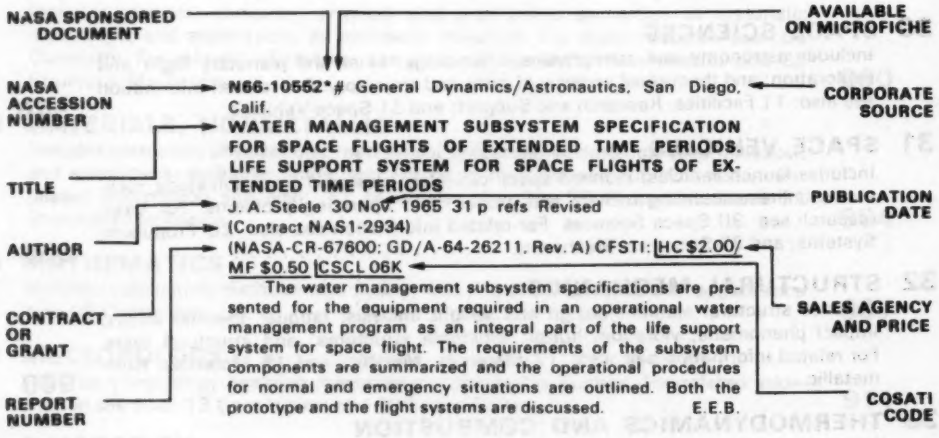
CORPORATE SOURCE INDEX I-63

PERSONAL AUTHOR INDEX I-77

REPORT/ACCESSION NUMBER INDEX I-101

ACCESSION/REPORT NUMBER INDEX I-111

TYPICAL CITATION AND ABSTRACT FROM *STAR*


NASA SPONSORED DOCUMENT
AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER
N66-10552*# General Dynamics/Astronautics, San Diego, Calif.
CORPORATE SOURCE
TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
AUTHOR
J. A. Steele 30 Nov. 1965 31 p refs Revised
(Contract NAS1-2934)
CONTRACT OR GRANT
(NASA-CR-67600; GD/A-64-26211, Rev. A) CFSTI: HC $2.00/ MF $0.50 CSCL 06K
SALES AGENCY AND PRICE
REPORT NUMBER
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed. E.E.B.
COSATI CODE

VOLUME 4 NUMBER 6

Scientific and Technical Aerospace Reports

A Semimonthly Publication
of the National Aeronautics and Space Administration

March 23, 1966

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N66-15232*# Meteorology Research, Inc., Altadena, Calif.
OPERATIONAL APPLICATION OF A UNIVERSAL TURBULENCE MEASURING SYSTEM Final Report
Paul B. Mac Cready, Jr., Robin E. Williamson, Stephen Berman, and Alexander Webster Nov. 1965 96 p refs
(Contract NAS4-784)
(NASA-CR-62025; MRI65-FR-301) CFSTI: HC $3.00/MF $0.75 CSCL 01A

A multi-phased program was conducted to advance the universal turbulence measurement concept toward operational status. The concept is based on the fact that there are simplifications in statistical turbulence relationships when concern is with the relatively small wavelengths which put the major gust loads on aircraft. A simple system called the Universal Indicated Turbulence System (UITS) gives an output reading R which is a quantitative measure of turbulence intensity unaffected by the characteristics or speed of the aircraft on which it is mounted. The UITS utilizes a high frequency dynamic pressure sensor. A UITS prototype was operationally tested in a T-33 aircraft demonstrating an all-weather capability. R indications and the observer's turbulence evaluations were reasonably consistent with the theoretical predictions. An Apache aircraft was instrumented for complete two-component, turbulence measurements. An estimate of the best averaging time for the UITS reading was obtained by analyzing the data from the Apache for the time histories of the power spectral density components and also by playing the Apache magnetic tape record into the final UITS circuitry. Author

N66-15306*# Wichita Univ., Kans. Dept. of Aeronautical Engineering.
A REVIEW OF THE PLANFORM EFFECTS ON THE LOW-SPEED AERODYNAMIC CHARACTERISTICS OF TRIANGULAR AND MODIFIED TRIANGULAR WINGS Final Report
Kenneth Razak and Melvin H. Snyder, Jr. Sep. 1965 109 p refs
(Grant NGR-17-03-002)
(NASA-CR-69247; AR-65-3) CFSTI: HC $4.00/MF $0.75 CSCL 01A

The fundamental aerodynamic phenomena of the flow around sharp leading edge triangular planform wings is reviewed. Analytical methods of predicting lift characteristics of triangular wings are summarized and experimental results of tests on wings of various planform are presented. A bibliography of 258 references is included. Author

N66-15335*# Marquardt Corp., Van Nuys, Calif.
AN INVESTIGATION OF CONTROLLED TETHERING IN SPACE
R. W. Adlhoch and W. H. Straly 26 Feb. 1965 144 p refs *Its* Rept.-6092
(Contract NAS1-3912)
(NASA-CR-69392) CFSTI: HC $4.00/MF $1.00 CSCL 01A

The purpose of the study was to provide the necessary analyses and preliminary designs, as well as development program plans, for controlled tethering/retrieval operations. The results may be applied to further development and flight testing of a controlled tethering system. The investigations include: (1) development of the equations of motion of connected bodies in orbit; (2) development of various operational philosophies for tethered retrieval; (3) investigation of tether line dynamics during retrieval; (4) analysis of gravity gradient effects; (5) development of a digital computer program for rapid investigation of overall orbiting system; and (6) development of preliminary design concepts for operational hardware. Author

N66-15389*# Ling-Temco-Vought, Inc., Dallas, Tex. Astronautics Div.
AN INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A 25° SPHERE-CONE INCLUDING A PRESSURE DISTRIBUTION ANALYSIS AT ANGLES OF ATTACK, AND A TRAJECTORY ANALYSIS DURING A TYPICAL REENTRY TRAJECTORY
John W. Arnold, Harmon L. Simmons, and William T. Miller [1965] 140 p refs
(Contract NAS1-3915)
(NASA-CR-66037) CFSTI: HC $4.00/MF $1.00 CSCL 01A

The aerodynamic data presented include force and moment derivatives, base pressure and skin friction data, and an estimate of the dynamic stability for Mach numbers up to (M)26. Also included is a detailed pressure distribution analysis for $M \geq 4$ and angles of attack up to 15 degrees. These data were obtained from a compilation, correlation, and interpolation of many data reports from several sources. As an aid in the selection of the minimum entry path angle commensurate with impact range requirements, nominal Scout launch vehicle performance in the form of burnout range versus burnout flight path angle is presented along with impact dispersion as a function of entry angle. A digital computer reentry trajectory study was conducted to establish the most favorable center of

gravity location and to determine the individual effects of tip-off, mass unbalance and center of gravity offset. The pitch frequency for the spinning body was determined for the nominal trajectory and several of the off-nominal cases. Author

N66-15429# Weapons Research Establishment (Australia).
THEORETICAL PRESSURE DISTRIBUTIONS ON A SERIES OF SUPERSONIC WING-BODY COMBINATIONS. PART III: DELTA WING RESULTS M = 2.58
Y. Y. Chan [1961] 29 p ref
(WRE-TM-HSA-87) CFSTI: HC $2.00/MF $0.50

Quasi-cylindrical theory is applied to calculate pressure distributions on a combination of a circular cylindrical body and a "supersonic" delta wing of leading edge sweepback 50 degrees, at the Mach number 2.58. Wing thickness results are given for both planar and cruciform configurations. Angle of attack effects are not treated. Author

N66-15432# Curtiss-Wright Corp., Caldwell, N. J. VTOL Systems Div.
A THEORY FOR VTOL PROPELLER OPERATION IN A STATIC CONDITION
John C. Erickson, Jr., Richard M. Ladden, Henry V. Borst, and Donald E. Ordway Ft. Eustis, Va., Army Aviation Materiel Labs., Oct. 1965 89 p refs Prepared jointly with Therm Advanced Res., Inc.
(Contract DA-44-177-AMC-165(T))
(USAAVLABS-TR-65-69; AD-623527) CFSTI: HC $3.00/MF $0.75

A general theory for performance calculations was formulated based on a continuous vortex representation along the lines of the classical lifting-line model. As opposed to forward flight, the deformation of the wake is appreciable just behind the propeller, and its determination constitutes the heart of the static problem. A computer program has been developed to calculate both the inflow at the propeller and the induced velocity at any field point for an arbitrary description of the trailing vortex sheets. To approximate the force-free condition imposed on the wake, an initial wake hypothesis derived from the theory of the Generalized Actuator Disk was first used. The resulting comparisons with both detailed and gross measurements were unsatisfactory and a refined hypothesis was derived. The refined wake hypothesis provides a more reasonable representation of the 'pitch' of the elements of the deformed trailing vortex sheets as well as the envelope of their trajectories.
Author (TAB)

N66-15445*# Rice Univ., Houston, Tex. Dept. of Mechanical and Aerospace Engineering and Materials Science.
MAXIMUM LIFT-TO-DRAG RATIOS OF SLENDER, FLAT-TOP, HYPERSONIC BODIES, PART I
Angelo Miele and David G. Hull 1965 32 p refs
(Grant NGR-44-006-034)
(NASA-CR-69383; AAR-10) CFSTI: HC $2.00/MF $0.50 CSCL 01A

An investigation of the lift-to-drag ratio attainable by a slender, flat-top, homothetic body flying at hypersonic speeds is presented under the assumptions that the pressure distribution is Newtonian and the skin-friction coefficient is constant. It is shown that a value of the thickness ratio exists such that the lift-to-drag ratio is a maximum; this particular value is such that the friction drag is one-third of the total drag. The subsequent optimization of the longitudinal and transversal contours is reduced to the extremization of products of powers of integrals related to the lift, the pressure drag, and the skin-friction drag. For the longitudinal contour, the variational approach shows that a conical solution is the best. For the transversal contour, a triangular configuration satisfies the Euler equation for every cross-sectional elongation ratio μ; it satisfies the Legendre condition for $0 \leq \mu \leq 0.65$ but violates it in the neighborhood of the plane of symmetry for $0.65 \leq \mu \leq 1$. The lift-to-drag ratio of the optimum conical body of triangular cross section increases as the elongation ratio of the cross section decreases; for a friction coefficient $C_f = 10^{-3}$, the highest attainable lift-to-drag ratio is E = 5.29. Author

N66-15467# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
LATERAL BLOWING FROM THE TIP OF A LOW ASPECT RATIO WING
O. W. Hoiby and J. A. Van der Bliek Feb. 1965 28 p refs
(VKI-TN-25) CFSTI: HC $2.00/MF $0.50

The pressure distribution of an aspect ratio two rectangular wing with lateral blowing from the tip was measured. It was found that lateral blowing increases the lift at all lateral stations with an extra lift increase near the tip. The stall angle of attack was little affected by lateral blowing. Author

N66-15530# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
REPORT OF THE MEETING OF THE AERODYNAMIC MEASURING TECHNIQUES SUB-COMMITTEE ON 17 NOVEMBER 1964 IN AACHEN [BERICHT UBER DIE SITZUNG DES UNTERAUSSCHUSSES AERODYNAMISCHE MESSTECHNIK AM 17. NOVEMBER 1964 IN AACHEN]
A. Heyser Feb. 1965 124 p In GERMAN
(DLR-65-01) CFSTI: HC $4.00/MF $1.00

The following topics were discussed by the subcommittee on aerodynamic measurement technology: (1) *Basic Concepts of Digital Data Computation and Data Evaluation;* (2) *Analog-to-Digital Data Conversion;* (3) *Computer Control in Automatic Data Sampling and System Evaluation;* (4) *Controls During Evaluation of Wind Tunnel Measurement Data;* (5) *Data Processing Installation for Subsonic Wind Tunnel;* (6) *Digital Data Sampling for Transonic Cascade Wind Tunnel at the Institute for Jet Propulsion.* Transl. by G.G.

N66-15581# Aircraft Research Association, Ltd., Bedford (England).
RESEARCH ON VORTEX BREAKDOWN ON SLENDER DELTA WINGS
Dietrich Hummel Oct. 1965 23 p refs Transl. into ENGLISH from Z. Flugwiss. (Brunswick, W. Germany), v. 13, no. 5, May 1965 Presented at joint Meeting of NGLR and OGRR, Berlin, 14–18 Sep. 1964
(ARA-LIB-TRANS-12) CFSTI: HC $1.00/MF $0.50

The results of experimental investigations on vortex breakdown on slender delta wings at low speed are presented. The phenomenon of vortex breakdown has been investigated by measuring the flow field over a delta wing of aspect ratio Λ = 0.78. The results are compared with the stability theory after H. Ludwieg. In order to determine the effect of vortex breakdown on the aerodynamic characteristics of a wing, six-component measurements and pressure-distribution measurements on a delta wing of aspect ratio Λ = 1.0 have been carried out. The forces and moments decrease when the vortices break down just above the wing. Author

N66-15583*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NACA CONFERENCE ON AERODYNAMICS OF HIGH-SPEED AIRCRAFT A Compilation of the Papers Presented

[1953] 664 p refs Conf. held 8–10 Jul. 1953

(NASA-TM-X-57121) CFSTI: HC $9.64/MF $3.25 CSCL 01A (Declassified)

Studies were directed toward wing-body combinations with the primary concern of improving lift-drag characteristics at supersonic speeds. Boundary layer control of wings was also studied along with the aerodyanmics of inlet scoops and channel flow. Turbulent skin friction and aerodynamic heating of reentry vehicles were also covered. C.L.W.

N66-15612*# Alabama Univ. Research Inst., Huntsville.

HYPERSONIC AERODYNAMIC PROBLEMS AT RE-ENTRY OF SPACE VEHICLES

Rudolf Hermann Nov. 1965 32 p refs Presented at the 4th Space Symp., Gottingen Univ., West Germany, 18–22 Oct. 1965 (Grant NsG-381)

(NASA-CR-69486; UARI-29) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The reentry of manned and unmanned satellite and space vehicles is discussed and the importance of the reentry trajectories in a velocity–altitude diagram is emphasized. Also, the degree of dissociation and some characteristics of ionization are shown as parameters in velocity–altitude diagrams. The problems associated with the electron density and collision frequency of the free electrons in a plasma sheath and the importance of these phenomena in radio communication blackout are considered. Results of calculations using the integral method for hypersonic flow of air with non-equilibrium oxygen dissociation are presented. A circular cylinder and a sphere were investigated up to Mach number 14 and a circular cone up to Mach number 20. In the case of the cylinder and the cone, calculations assuming dissociation of the free stream were included. It was found that the shock wave moves closer to those bodies with increasing Mach number, but with rising free stream dissociation at otherwise fixed conditions, the shock wave moves away from the body. E.E.B.

N66-15629# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).

A WINDTUNNEL INVESTIGATION OF THE BUFFET LOADS AND BUFFET PRESSURES ON THE ELDO SATELLITE LAUNCHING VEHICLE

J.W. G. van Nunen 29 Jul. 1965 81 p refs Supersedes FF-15 (F-244; FF-15) CFSTI: HC $3.00/MF $0.75

On a model of scale 1:10, representing the forward part of the ELDO satellite launching vehicle, a "quick-look" program has been carried out to determine the buffet loads and the buffet pressures, that occur in the transonic region. Two different nose cone angles have been investigated, 60° and 40° resp., at several angles of incidence; further the shoulder radius and the model frequency have been varied. Also some runs have been performed at lower stagnation pressures. A limited test program has been carried out to determine static pressures on the model and fluctuating pressures in the tunnel test section. Finally some buffet pressures have been analysed to determine their power spectra. The results show that the buffet loads are very low. From the power spectral analysis it is concluded, that the power of the buffeting pressures is concentrated in the lower frequencies region. No correlation has been found between the buffet pressures on the model and the fluctuating pressures in the test section. Author

N66-15730# Aerodynamische Versuchsanstalt, Gottingen (West Germany).

TABLES AND DIAGRAMS OF THE AUXILIARY FUNCTIONS Sn CORRESPONDING TO THE THEORY OF THE OSCILLATING LIFTING SURFACE OF LARGE ASPECT RATIO [TABELLEN UND DIAGRAMME DER HILFSFUNKTIONEN Sn ZUR THEORIE DER SCHWINGENDEN TRAGFLACHE GROSSER STRECKUNG

H. Gollnitz May 1965 69 p refs In GERMAN; ENGLISH summary

(DLR-FB-65-20; AVA-FB-65-06) CFSTI: HC $3.00/MF $0.75

In the theory of the oscillating lifting surface of large aspect ratio developed by H. G. Küssner and M. Dingel, a condition of normal velocity is given as integral equation containing auxiliary functions S_n. For incompressible flow, tables of these auxiliary functions have been calculated and diagrams have been plotted. Author

N66-15745# Aerodynamische Versuchsanstalt, Gottingen (West Germany).

WAKE INFLUENCE ON WEDGE FLOWS [TOWASSERBEEINFLUSSUNG BEI KEILSTROMUNGEN]

M. Tanner Nov. 1964 73 p refs In GERMAN; ENGLISH summary

(DLR-FB-64-39; AVA-FB-64-03) CFSTI: HC $3.00/MF $0.75

New experimental investigations of the base pressure especially concerning the possibilities of its influencing are performed in a two-dimensional wind tunnel. They should explain the way in which the wake can be influenced by suction or blowing, by a splitter plate in the wake or by suction and blowing through a splitter plate. The base pressure, the length of the closed wake bubble, the pressure distribution on the surface of the wedge and on the centerline of the wake have been measured. Author

N66-15762# General Dynamics/Pomona, Daingerfield, Tex. Ordnance Aerophysics Lab.

MACH NUMBER TABLES (γ = 1.4) WITH CORRECTION FACTORS FOR REAL AIR

H. C. Kerr 9 Apr. 1964 382 p refs

(Contract NOw-63-0405-c)

(OAL-MEMO-147-1; CM-1036-1; AD-624598) CFSTI: HC $7.00/MF $1.75

This memorandum is composed of three tables, along with a brief description of each. It is well known that the common Mach tables for air (γ = 1.4) are accurate only if the temperature of the flow is everywhere comparatively low. In order to increase the usefulness of these tables, certain auxiliary tables of correction factors have been constructed which give satisfactory results over a wide range of total temperatures and pressures. These auxiliary tables apply a correction factor to the common Mach tables and must therefore be used in conjunction with them. The factors are very easy to apply and they greatly increase the accuracy of the ordinary Mach tables within the limits of the assumptions made. TABLE I: Thirteen Mach functions useful in flow analysis are tabulated over a wide range of Mach number values: $0 \leq M \leq 25$. Both the isentropic and the normal shock functions are included. All results are based on γ = 1.4. TABLE II: This table lists correction factors for the Mach functions of Table I associated with the isentropic flow of real air. It covers the ranges: $1 \leq P(atm) \leq 500$; $900 \leq T(R) \leq 12\,600$; $O_2 \leq M \leq 5$ to 25. TABLE III: This table is similar to Table II, except it lists the correction factors for the Mach functions of Table I associated with the flow of real air across a normal shock. Author (TAB)

N66-15796# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
OPTIMUM SHAPE OF A BODY OF REVOLUTION WITH BASE DRAG AT SUPERSONIC SPEED
J. Raat, F. van der Walle, and P. J. Zandbergen 16 Sep. 1964 66 p refs
(NLR-TN-G-22) CFSTI: HC $3.00/MF $0.75

This report gives a method to determine optimum shapes of bodies of revolution taking into account the shape dependent part of the base drag. This is achieved by using a condition due to Chapman for the conditions near the base. The drag reductions are the most significant for slender bodies at low supersonic Mach numbers. Author

N66-15883# National Aerospace Lab., Tokyo (Japan).
AN APPROXIMATE CALCULATION FOR SUPERSONIC FLOW PAST BODIES OF ROCKET VEHICLES. PART I: LINEARIZED FLOW WITH AXIAL SYMMETRY
Takashi Tani 1965 24 p refs In JAPANESE; ENGLISH summary
(NAL-TR-92) CFSTI: HC $1.00/MF $0.50

The supersonic air flow past bodies of rocket vehicles is treated. The equation is transformed to the simplest wave equation in the vicinity of the body surface. This method is useful for the cylindrical body with slope discontinuities. In this report the linearized flow with axial symmetry is investigated. The results indicate good agreement with the results by other authors and experimental values. Author

N66-15941# Fraunhofer Institut., Freiburg (West Germany).
THE RESISTANCE BEHAVIOR OF SPHERES IN A TRANSONIC VELOCITY ZONE [DAS WIDERSTANDSVERHALTEN VON KUGELN IM TRANSSONISCHEN GESCHWINDIGKEITSBEREICH]
A. Stilp Feb. 1965 43 p refs In GERMAN
(Rept.-1/65) CFSTI: HC $2.00/MF $0.50

The aerodynamic resistance of spherical projectiles at Mach number 1 was measured in an aeroballistic tunnel. It was found that resistance values were not dependent on the Reynolds number, even at Mach numbers $0.75 < M < 1.05$. A variation in value at $0.85 < M < 1.0$ from earlier established measurements was attributed to the alternating effects of the turbulent boundary layer with the stationary transonic velocity field. Spheres with rough surfaces showed the same aerodynamic resistance as those with smooth surfaces.
Transl. by G.G.

N66-16005# Hiller Aircraft Corp., Palo Alto, Calif.
HEAVY-LIFT TIP TURBOJET ROTOR SYSTEM. VOLUME VIII: WIND-TUNNEL STUDIES
Ft. Eustis, Va., Army Aviation Mater. Labs., Oct. 1965 540 p refs *Its* Eng. Rept.-64-48
(Contract DA-44-177-AMC-25(T))
(USAAVLABS-TR-64-68H; AD-624814) CFSTI: HC $8.00/MF $2.25

Wind-tunnel tests were conducted to provide nacelle design information which would assist in the design of the tip turbojet installation. The model was constructed to provide for single, over-under, and side-by-side engine arrangements. The nacelle loads were measured with a six-component strain-gage balance. Tests were conducted at nacelle Reynolds numbers from 450 000 to 1 830 000 with most of the data taken at the higher value. The model pitch angle was varied from −3 degrees to +12 degrees and the yaw angle was varied from −20 degrees to +20 degrees. Nacelle inlet to freestream velocity ratios were varied from 0 to .7625, the maximum obtainable with freestream total pressure supplying the energy necessary to overcome internal losses. Author (TAB)

N66-16012# Aerodynamische Versuchsanstalt, Gottingen (West Germany). Abteilung Aeroelastizitaet.
THEORY OF THE OSCILLATING LIFTING SURFACE OF LARGE ASPECT RATIO IN THE SUBSONIC REGION [THEORIE DER SCHWINGENDEN TRAGLAECHE GROSSER STRECKUNG IM UNTERSCHALLBEREICH]
H. G. Küssner and H. Hertrich May 1965 109 p refs In GERMAN; ENGLISH summary
(AVA-FB-65-05; DLR-FB-65-19) CFSTI: HC $4.00/MF $1.00

The approximative theory of the oscillating lifting surface of large aspect ratio given by H.G. Küssner in 1940 is deduced also for compressible flow. Using former reports of the Aerodynamische Versuchsanstalt a method of solution by harmonic analysis is deduced. The lift distribution in spanwise direction is calculated for incompressible flow, different plan forms, modes and reduced frequencies. The results are compared with those given in former papers. Author

N66-16057*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF THE SHARP RIGHT CIRCULAR CONE AT MACH 20.3 AND ANGLES OF ATTACK TO 110° IN HELIUM
Dal. V. Maddalon Washington, NASA, Feb. 1966 54 p refs
(NASA-TN-D-3201) CFSTI: HC $3.00/MF $0.50 CSCL 01A

A study of the static longitudinal aerodynamic characteristics of the sharp right circular cone at a Mach number of 20.3 and a Reynolds number of 0.37×10^6 per inch (14.6×10^6 per meter) in helium has been conducted. Results of the investigation were compared with exact theory, Cheng's cone theory, Newtonian theory, and existing data obtained in air at a Mach number of about 6.8. Generally, good agreement was obtained with both theory and data obtained in air except when the total angle (cone half-angle plus angle of attack) was great enough to promote nonconical flow. The center-of-pressure location was essentially constant within certain regions of angle of attack. Also, the normal-force and pitching-moment coefficients obtained in the present investigation were correlated with cone data at various bluntness ratios and Mach numbers. Author

N66-16090*# Northrop Space Labs., Huntsville, Ala.
A SUPERSONIC/HYPERSONIC AERODYNAMIC INVESTIGATION OF THE SATURN IB/APOLLO UPPER STAGE
David R. Carlson and William P. Walters Washington, NASA, Jan. 1966 78 p refs Supersedes NASA-CR-61072; See X65-17330
(Contract NAS8-11111)
(NASA-CR-362) CFSTI: HC $3.00/MF $0.75 CSCL 01A

The static stability and axial force characteristics of an upper stage Saturn IB/Apollo model were investigated in a series of wind tunnel tests at Mach numbers between 1.93 and 8.05. This report presents and analyzes the results of these small-scale studies. Test procedures and models are described, and consideration of boundary layer characteristics and violated modeling rules yields an assessment of the validity of the data. Four basic models provided evaluation of the basic launch vehicle characteristics, as well as the effects of two modes of mission abort and jettison of the launch escape system. The launch configuration experienced sudden, strong changes in stability derivatives and axial force coefficients near Mach 5. No similar changes were observed on the other configurations. Effects of Reynolds number, Mach number, and boundary layer trips were obtained for each shape. The faired curves are believed to be valid for full-scale flight of the Saturn IB/Apollo upper stage. Author

N66-16098# Weapons Research Establishment (Australia).
THEORETICAL PRESSURE DISTRIBUTIONS ON A SERIES OF SUPERSONIC WING–BODY COMBINATIONS. PART IV: DELTA WING RESULTS M = 2.00
Y. Y. Chan [1960] 32 p ref
(WRE-TM-HSA-88) CFSTI: HC $2.00/MF $0.50

Quasi-cylindrical theory is employed to calculate the pressure distributions on a combination of a circular cylindrical body and a supersonic delta wing of leading edge sweep-back 50 degrees at Mach number M = 2.00. The results due to the thickness and the incidence of the wing are given for the planar and the cruciform configurations. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N66-15231*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GROUND EFFECTS ON SINGLE-JET AND MULTIPLE-JET VTOL MODELS AT TRANSITION SPEEDS OVER STATIONARY AND MOVING GROUND PLANES
Raymond D. Vogler Washington, NASA, Jan. 1966 68 p refs
(NASA-TN-D-3213) CFSTI: HC $3.00/MF $0.75 CSCL 01C

An investigation was made to determine ground effects and jet-free-stream interference effects on the longitudinal characteristics of a VTOL wing-fuselage model at low forward speeds and equipped with various interchangeable arrangements of single and multiple vertical jets. Out-of-ground effect for all configurations showed interference lift losses and nose-up pitching moments that increased with the ratio of the effective free-stream-to-jet velocity. With the model one or two effective jet diameters above the ground plane, the data showed large additional losses in lift for some configurations and reduced losses for other configurations when compared with the out-of-ground-effect data. The additional pitching-moment increments also varied with configurations, but the moment changes did not parallel the lift changes. The difference in effects between a ground plane moving with free-stream velocity and a stationary ground plane was small except at the highest velocity ratios with the model 1 effective jet diameter from the ground plane. Under these conditions, the model over the moving ground plane experienced slightly less lift loss and a small nose-up increment in pitch for most configurations. Author

N66-15281*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RECENT SUPERSONIC TRANSPORT RESEARCH
William J. Alford, Jr. and Cornelius Driver, comp. [1965] 65 p refs Submitted for Publication
(NASA-TM-X-54982) CFSTI: HC $3.00/MF $0.75 CSCL 01C

A review is given of some of the major research in support of the supersonic transport with emphasis in the areas of improved flight efficiency, stability and control, structures and materials, and operating problems. In the area of performance aerodynamics, theoretical methods for calculating and minimizing wave drag, drag due to lift, and sonic boom effects have been programmed for use on high speed digital computers. In the propulsion area, mission and engine cycle studies have demonstrated the importance of careful airframe and propulsion system integration and matching. Stability and control research indicates that flight at high altitudes presents problems in providing adequate damping of the dynamic stability modes and probably will require three axis damping augmentation. With regard to structures and materials it has been determined that design to accommodate thermal stresses will incur penalties of a few percent in structural weight. Operating problem research includes studies in such areas as traffic control and engine noise. C.T.C.

N66-15405*# Stevens Inst. of Tech., Hoboken, N. J. Davidson Lab.
HYDROPLANING OF AIRCRAFT TIRES Third Quarterly Progress Report, 15 Apr.–15 Jul. 1965
15 Jul. 1965 12 p refs
(Contract NSR-31-003-016)
(NASA-CR-69331) CFSTI: HC $1.00/MF $0.50 CSCL 01C

In the systematic experimental study of the various parameters affecting aircraft tire hydroplaning, modification of the rolling road was completed, along with the installation of the 40 hp drive motor, power supply and control system, and the heavy duty rubber timing belt transmission system. Problems connected with belt operation are discussed. Static and dynamic testing of polyurethane scale model tires indicated that these models, with geometric properties similar to pneumatic tires, can be produced by known methods; fabrication of such tires was begun. A tentative program for the rolling road tests, including the basic variables and their projected values, is also included. M.G.J.

N66-15469# Lockheed-Georgia Co., Marietta.
C-141A INTERIOR ACOUSTICAL NOISE MEASUREMENTS—A/C NO. 6004(AF 612778)
J. S. Gibson 7 Sep. 1965 57 p refs
(Contract AF 33(600)-42941)
(ER-4932; AD-469657)

This report presents the measured acoustical noise environment for the interior of the C-141A aircraft and a description of the production soundproofing treatment as required by MIL-A8806. The measured acoustical noise environment for the required flight conditions is well below specification limits in most octave bands. There are a few insignificant instances where the measured noise levels exceed the specification by one or two decibels. Author (TAB)

N66-15525# Barry Controls Div., Barry Wright Corp., Watertown, Mass. Research and Development Branch.
IN-FLIGHT EVALUATION OF CONVENTIONAL AND FOAM SHOCK AND VIBRATION ISOLATION SYSTEMS Phase Report, Jun. 1962–Apr. 1965
P. C. Calcaterra Johnsville, Pa., Naval Air Develop. Center, 15 Sep. 1965 67 p refs
(Contract N62269-1862)
(NADC-AE-6506; AD-472890)

The design and installation of conventional and special foam mounting bases is given. Details of the equipment and bases tested, aircraft locations, instrumentation, maneuvers, and direction and type of excitation and response measured during controlled flight tests are given. Acceleration spectral density values, total RMS acceleration values, and acceleration-time histories of the excitation at various aircraft locations are presented for various flight conditions, catapult launches, and arrestment landings. Evaluation is made on the basis of effective vibration transmissibility, peak equipment acceleration under shock, and fleet service maintenance reports. Author (TAB)

N66-15643*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

CONTROL EXPERIENCES OF THE X-15 PERTINENT TO LIFTING ENTRY

Euclid C. Holleman Washington, NASA, Feb. 1966 16 p refs (NASA-TN-D-3262) CFSTI: HC $1.00/MF $0.50 CSCL 01D

In the program to expand the flight envelope of the X-15 airplane, flights to and entries from altitudes up to 350,000 feet have been accomplished. During these entries, flight-control experience was obtained with four different control-system configurations having varying degrees of complexity. The high steady acceleration and rapidly changing aerodynamic environment did not affect the pilot's capability to control the entry. All the control systems evaluated were judged by the pilots to be satisfactory for the control of the X-15 entry from the design altitude. Entries have been made that presented more severe control problems than predicted for entries of advanced vehicles at higher velocities. Author

N66-15644*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

A SUMMARY OF THE X-15 LANDING LOADS

James M. Mc Kay and Richard B. Noll Washington, NASA, Feb. 1966 13 p refs

(NASA-TN-D-3263) CFSTI: HC $1.00/MF $0.50 CSCL 01C

The dynamic response of the X-15 airplane at touchdown is reviewed briefly to show the unusual landing characteristics resulting from the airplane configuration. The effect of sinking speed is discussed, as well as the influence of the horizontal-stabilizer load, wing lift, and increased landing weight on the landing characteristics. Consideration is given to some factors providing solutions to these problems, such as cutout of the stability augmentation damper at gear contact, pilot manipulation of the stabilizer, the use of a stick pusher at touchdown, and a proposed third skid installed in the unjettisoned portion of the lower ventral fin. Studies to determine the effect on the main-landing-gear loads of relocating the X-15 nose gear are discussed. Author

N66-15671# Aeronautical Research Inst. of Sweden, Stockholm.

ANALYSIS OF THE PROBABILITY OF COLLAPSE OF A FAIL-SAFE AIRCRAFT STRUCTURE CONSISTING OF PARALLEL ELEMENTS

Sigge Eggwertz and Goran Lindsjo 1965 42 p refs Supersedes HU-961; RTD-TDR-53-4210; See N64-17150

(Grant AF-EOAR-61(052)-573)

(FFA-102; HU-961; RDR-TDR-63-4210) CFSTI: HC $2.00/MF $0.50

A study is made of the probability of collapse of a fail-safe structure, consisting of a number of parallel members, and subjected to a random load spectrum. In the individual member a fatigue crack is first initiated and failure of the member occurs due to a heavy load on the weakened member. The probability of element failure is obtained by a combination of the probabilities of crack initiation and of meeting a load exceeding the residual strength of the member. The probability of consecutive element failures is deduced from the probability of failure of the individual members. Collapse occurs when all members are broken, or, in practice, after a critical number of element failures within one inspection interval. The probability of collapse of the assembly during the whole service life results from a combination of the probabilities of all the inspection intervals. A numerical procedure for calculating the probability of collapse has been developed and evaluations have been made for an assembly of six identical, parallel members. Diagrams of the probability of collapse versus the service life time have been plotted for various lengths of regular inspection intervals, assuming different values of the crack initiation and strength reduction parameters introduced. Some preliminary fatigue testing of single specimens and assemblies show a good agreement with theory within a limited region around 50 percent probability of failure. Author

N66-15712# Interior Dept., Washington, D. C. Bureau of Sport Fisheries and Wildlife.

BIOLOGICAL STUDIES OF THE PROBLEM OF BIRD HAZARD TO AIRCRAFT Final Report, Jul. 1, 1963–Jun. 30, 1964

John L. Seubert Jun. 1965 34 p Prepared for FAA

(RD-65-73; AD-624464) CFSTI: HC $2.00/MF $0.50

Research was continued on the bird–airport problem. Commercial carriers reported 337 bird–plane strikes in 1963 with gulls and waterfowl again the most important hazard species. In a 1-year study at Washington National Airport and nearby Roaches Run Waterfowl Sanctuary, 20 bird species were rated potentially hazardous because they were numerous and present for extended periods. Productivity was reduced significantly when herring gull eggs were treated with an oil-formaldehyde mixture. Surveys showed the presence of eider ducks, cormorants, laughing gulls, and herons on gull breeding islands, and that herring gulls continued to concentrate at metropolitan food sources. Four gull species were repelled from two airports with broadcast gull distress calls. Caged herring gulls reacted little if at all when exposed to laser beams of 1 to 200 joules. The 'head and shoulders' waves on which the original reported similarity between electra engines and insect sounds was based also were found in memoscope tracings of sounds of other aircraft and other animals. Chemical solutions were evaluated as taste stimuli for herring gulls, starlings, and red-winged blackbirds. Individual variation in taste was substantial. An international meeting in 1963 on the bird–aerodrome problem acknowledged that bird problems exist, and recommended that remedial measures be taken, that airplane design requirements be standardized, and that national committees be formed. Author (TAB)

N66-15737# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).

REVIEW OF LITERATURE ON AVIATION TECHNOLOGY [LITERATUUROVERZICHT, LUCHTVAART-TECHNIEK]

12 Oct. 1965 19 p In DUTCH *Its* Vol. 13, No. L-284

Abstracts compiled from a literature review of research and development efforts in several countries are presented. Categories include model descriptions, propulsion, industrial materials, panel systems and instruments, navigation and air traffic control, safety, aerodynamics, strength and vibration experiments, and loading. Data on operating costs are also included. Transl. by J. O.

N66-15994# Federal Aviation Agency, Washington, D. C. Office of Supersonic Transport Development.

SONIC BOOM RESEARCH AND DESIGN CONSIDERATIONS IN THE DEVELOPMENT OF A COMMERCIAL SUPERSONIC TRANSPORT (SST)

Thomas H. Higgins [1965] 32 p refs Presented at the 70th Meeting of the Acoust. Soc. of Am., St. Louis, 3 Nov. 1965 (SST-65-19; AD-624050) CFSTI: HC $2.00/MF $0.50

This paper presents a short history of sonic boom research and related operational considerations in the development of a commercial supersonic transport (SST). The most intensive public reaction research program to date was conducted at Oklahoma City, Oklahoma. An intensive research program to determine structural reaction to sonic booms was conducted at the White Sands Missile Range. These two programs are

discussed and a brief summary of the findings of the programs is presented. The paper concludes that although much has been learned about the sonic boom phenomena through past flight and research activities, additional research and theoretical studies are warranted. Author (TAB)

N66-16164*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
JET-INDUCED LIFT LOSSES ON VTOL CONFIGURATIONS HOVERING IN AND OUT OF GROUND EFFECT
Garl L. Gentry and Richard J. Margason Washington, NASA, Feb. 1966 77 p refs
(NASA-TN-D-3166) CFSTI: HC $3.00/MF $0.75 CSCL 01C

The effects of the pressure ratio, of the ratio of planform area to jet area, and of the wing height on the lift loss due to the suction pressures induced on the lower surface of the fuselage and wings of a VTOL aircraft by the entrainment action of the vertical efflux from the lifting jets have been investigated at small scale. The induced loads were found to amount to approximately 1 percent of the thrust for single-jet VTOL configurations and 3 to 4 percent of the thrust for multiple jets out of ground effect. The jet-induced loads were found to be a function of the square root of the ratio of planform area to jet area and were strongly influenced by the rate at which the jet entrained the surrounding air and by the distance between the area of maximum entrainment and the lower surface of the fuselage. An empirical expression for calculating the jet-induced loads was derived. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N66-15227*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Astropower Lab.
INORGANIC ION EXCHANGE MEMBRANES FUEL CELL Final Report
C. B. Berger and M. P. Strier Oct. 1965 177 p refs
(Contract NAS3-6000)
(NASA-CR-54784; SM-46221-F) CFSTI: HC $5.00/MF $1.00 CSCL 10A

The most significant achievement of this program has been the development of a zirconium phosphate membrane impregnated with catalyst which can perform in a fuel cell at 0.77 to 0.78 volts at 30 ma/cm^2. This type of fuel cell can operate continuously for at least 1200 hours and has a capability of operating at a temperature of as high as 151°C. Extrapolations of enhanced electrocatalytic activity (i.e., higher catalyst loading in the membrane) and lower membrane resistivity down to the 1 ohm-cm level indicate that a fuel cell performance of 0.840 to 0.850 volts at 30 ma/cm^2 and 0.820 volts at 50 ma/cm^2 should be possible for the inorganic membrane fuel cell. What is most unusual about the membrane is its high strength and favorable conductivity and stability. The incorporation of the zeolite component is conducive particularly to the latter. Author

N66-15251# Joint Publications Research Service, Washington, D. C.
HELIOTECHNOLOGY
21 Dec. 1965 79 p refs Transl. into ENGLISH from Geliotekhn. (Tashkent), v. 1, no. 1, 1965 p 6–70, 73–74
(JPRS-33417; TT-65-33991) CFSTI: $3.00

CONTENTS:

1. THERMOELECTRIC SOLAR ENERGY CONVERTERS U. A. Arifov and A. I. Kulagin p 1–11 refs (See N66-15252 06-03)

2. POWER PLANT TO CONVERT SOLAR ENERGY INTO ELECTRICITY A. P. Landsman, M. D. Yagudayev, N. V. Shavrin, and Yu. M. Yuabov p 12–17 refs (See N66-15253 06-03)

3. A SOLAR VACUUM FILM COLLECTOR 2.7 M IN DIAMETER S. V. Starodubtsev, G. Ya. Umararov, and N. V. Kordub p 18–19 (See N66-15254 06-03)

4. EXPERIMENTAL DETERMINATION OF THE SHAPE OF AN INFLATABLE FILM COLLECTOR REFLECTING SURFACE G. Ya. Umarov, N. V. Kordub, V. P. Bespal'ko, and A. Gafurov p 20–24 ref (See N66-15255 06-03)

5. A COLLECTOR ON AN ASBESTOS-CEMENT BASE S. V. Starodubtsev, U. A. Arifov, G. Ya. Umarov, N. V. Kordub, and S. Akhmedov p 25–27 refs (See N66-15256 06-03)

6. A HIGH-TEMPERATURE SOLAR FURNACE 2 M IN DIAMETER M. D. Yagudayev, A. Ya. Bashnyak, Yu. Ye. Nechayev, Yu. Z. Mavashev, and V. L. Rudshteyn p 28–35 refs (See N66-15257 06-03)

7. IMPROVEMENT IN PROPERTIES OF POLYMER FILMS UNDER INFRARED RADIATION G. A. Kleyn, L. Kh. Osipova, M. G. Sultanova, and R. I. Alimova p 36–39 refs (See N66-15258 06-18)

8. THE SPECTRAL CONSTITUTION OF DIRECT SUNLIGHT Ye. A. Lopukhin p 40–44 ref (See N66-15259 06-13)

9. HELIOTHERAPY DEVICE USING COMBINED ACTION OF TOTAL AND DIFFUSE SOLAR RADIATION V. S. Svarichevskiy p 45–49 refs (See N66-15260 06-04)

10. SOLAR WATER-COIL WATER-HEATER FOR SHOWERS A. Sh. Sharafi p 50–51 ref (See N66-15261 06-03)

11. COMPARISON HEAT ENGINEERING TESTS OF DOMESTIC AND OTHER KINDS OF SMALL SOLAR INSTALLATIONS Ya. G. Kolos p 52–60 refs (See N66-15262 06-03)

12. A HEXAGONAL HONEYCOMB THIN-FILM SOLAR RAY COLLECTOR G. Ya. Umarov, N. V. Kordub, Yu. Ye. Klyuchevskiy, A. A. Alimov, and Ye. I. Trot'yakova p 61–63 refs (See N66-15263 06-03)

13. ON AUTOMATING SOLAR UNIT TRACKING A. Sh. Sharafi p 64–66 (See N66-15264 06-03)

14. COORDINATING CONFERENCE ON HELIOTECHNOLOGY G. A. Kleyn p 67

15. PLENUM OF THE HELIOTECHNOLOGICAL SECTION OF THE CENTRAL SCIENTIFIC TECHNICAL ASSOCIATION OF THE POWER INDUSTRY P. I. Estrin p 68–69

N66-15252 Joint Publications Research Service, Washington, D. C.
THERMOELECTRIC SOLAR ENERGY CONVERTERS
U. A. Arifov and A. I. Kulagin *In its* Heliotechnology 21 Dec. 1965 p 1–11 refs (See N66-15251 06-03) CFSTI: $3.00

Achievements in the field of thermoelectric energy conversion are discussed. The properties of various low, medium, and high temperature semiconductor materials for use as thermoelectric materials are briefly described. The design characteristics of a number of conventional, nuclear, and solar thermoelectric generators are discussed. Present technology can produce small sized solar thermoelectric generators. However, many unresolved problems exist such as the commutation of

semiconductor thermoelectric materials and the electrical insulation of the heated side of a thermogenerator while providing satisfactory heat transfer from the heat source to the thermoelement, heat transport from the cold junction of the thermogenerator, and weight and area limits of the radiator which decrease thermodynamic efficiency and prevent the production of powerful thermoelectric generators for space applications. R.N.A.

N66-15253 Joint Publications Research Service, Washington, D. C.

POWER PLANT TO CONVERT SOLAR ENERGY INTO ELECTRICITY

A. P. Landsman, M. D. Yagudayev, N. V. Shavrin, and Yu. M. Yuabov *In its* Heliotechnology 21 Dec. 1965 p 12–17 refs (See N66-15251 06-03) CFSTI: $3.00

A power plant for converting solar energy to electricity was produced which has an average output of 150 watts. The plant uses a solar parabolic cylindrical concentrator and a silicon photobattery. The device has been tested in which failure free operation of the entire system was demonstrated. Energy conversion efficiency can be improved if photoconverters are used whose voltage and current temperature characteristics are better than those of the presently used silicon photocells (e.g. photocells of gallium arsenide). In addition a silicon photobattery of almost 2 m^2 in area is needed to produce a current of 150 watts under ordinary illumination. Its cost is also very high. R.N.A.

N66-15254 Joint Publications Research Service, Washington, D. C.

A SOLAR VACUUM FILM COLLECTOR 2.7 M IN DIAMETER

S. V. Starodubtsev, G. Ya. Umararov, and N. V. Kordub *In its* Heliotechnology 21 Dec. 1965 p 18–19 (See N66-15251 06-03) CFSTI: $3.00

A description is presented of a solar vacuum film collector 2.7 meters in diameter consisting of a film mirror, and a vacuum chamber in the form of a frustrum of a cone with ribbed walls and struts for zenith and azimuth orientation to the sun. The tracking system consists of an optical sensor using silicon photocells and a relay block. The entire unit is set on a reinforced concrete foundation and the vacuum chamber housing construction has proven sufficiently stable to withstand all wind loads. The film is hermetically sealed on the open side of the conical vacuum chamber and under even pressure assumes a mirror surface of good reflecting power which concentrates the radiant energy flux. By altering the vacuum in the chamber, mirrors can be obtained which concentrate radiant energy at a given focal length. R.N.A.

N66-15255 Joint Publications Research Service, Washington, D. C.

EXPERIMENTAL DETERMINATION OF THE SHAPE OF AN INFLATABLE FILM COLLECTOR REFLECTING SURFACE

G. Ya. Umarov, N. V. Kordub, V. P. Bespal'ko, and A. Gafurov *In its* Heliotechnology 21 Dec. 1965 p 20–24 ref (See N66-15251 06-03) CFSTI: $3.00

Experiments were conducted to determine the shape of the reflecting surface of an inflatable film collector in its relation to the differential between pressures on both sides of the film. The surface reflector was a metallized polyethylene terephthalate film 13.5 microns thick and 50 cm in diameter. The principle of determining the shape of the reflecting surface involved comparing the actual shape of the surface with shapes figured on the assumption that the reflecting surface adopts the shape of a segment of a sphere or a paraboloid of rotation. To determine the actual shape of the reflecting surface, the shadows of the outlines of the film cast by a stream of parallel light rays from a projector mirror are projected onto a plane and the shadows are photographed. Tensile stresses are applied to the film by forcing in air and the corresponding degree of the depth of curvature of the reflecting surface is derived. The formulation used, the tabulated data derived, and a discussion of the results are included. R.N.A.

N66-15256 Joint Publications Research Service, Washington, D. C.

A COLLECTOR ON AN ASBESTOS–CEMENT BASE

S. V. Starodubtsev, U. A. Arifov, G. Ya. Umarov, N. V. Kordub, and S. Akhmedov *In its* Heliotechnology 21 Dec. 1965 p 25–27 refs (See N66-15251 06-03) CFSTI: $3.00

Experiments were conducted on the mirror surface of a solar collector with an asbestos–cement base to determine its integral reflection coefficient. The mirror surface was metallized polyethylene terephthalate film. The integral reflection coefficient was calorimetrically determined and the procedure is described. The results are tabulated and show that the optical characteristics of the asbestos–cement based concentrator are not inferior to those of cast glass concentrators. The mean value of the integral coefficient of reflection of the concentrator is 0.78. The low reflection coefficient is attributed to dispersion of radiant energy because of film deformation. The investigations indicate that it is possible to lower the manufacturing costs and weight of spherical collector mirrors and to produce large size collectors in various patterns. R.N.A.

N66-15257 Joint Publications Research Service, Washington, D. C.

A HIGH-TEMPERATURE SOLAR FURNACE 2 M IN DIAMETER

M. D. Yagudayev, A. Ya. Bashnyak, Yu. Ye. Nechayev, Yu. Z. Mavashev, and R. L. Rudshteyn *In its* Heliotechnology 21 Dec. 1965 p 28–35 refs (See N66-15251 06-03) CFSTI: $3.00

A high temperature solar furnace consisting of a parabolic reflector with a mirror two meters in diameter and an orientation mechanism, each with its own system of azimuth-zenith axes, is described. The device is designed for direct aiming of the reflector at the sun and working the heliostat with the optical axis of the paraboloid horizontal. The reflector design, tracking system, method for determining heat flux at focus, and methods for experimentally determining the optical characteristics of high temperature solar furnaces are discussed. The thermal engineering and optical parameters of the solar furnaces described indicate the fine precision of the devices making it possible to gather high temperature and high energy fluxes. The design of the furnace and its tracking system makes it possible to conduct high temperature research using all the advantages of solar furnaces. R.N.A.

N66-15261 Joint Publications Research Service, Washington, D. C.

SOLAR WATER-COIL WATER-HEATER FOR SHOWERS

A. Sh. Sharafi *In its* Heliotechnology 21 Dec. 1965 p 50–51 ref (See N66-15251 06-03) CFSTI: $3.00

A solar coil water heater for showers is described. The device is inexpensive, simple in construction and use, and can be easily fitted into apartment buildings with flat roof construction. R.N.A.

N66-15262 Joint Publications Research Service, Washington, D. C.

COMPARISON HEAT ENGINEERING TESTS OF DOMESTIC AND OTHER KINDS OF SMALL SOLAR INSTALLATIONS

Ya. G. Kolos *In its* Heliotechnology 21 Dec. 1965 p 52–60 refs (See N66-15251 06-03) CFSTI: $3.00

The use of domestic solar installations with and without collectors of direct solar radiation for use in remote regions is discussed. Hot box type solar units, efficient in the 30° to 40° C temperature range, can be used to heat water, dry fruits and vegetables, distill water, and refrigerate. Units with paraboloid and parabolocylindrical concentrators can increase their temperature range to 100° C. The efficiencies of several types of solar units with and without concentrators are calculated and manufacturing and operating costs are compared with those for electric heating devices. The solar units are recommended from both technological and economic viewpoints. R.N.A.

N66-15263 Joint Publications Research Service, Washington, D. C.

A HEXAGONAL HONEYCOMB THIN-FILM SOLAR RAY COLLECTOR

G. Ya. Umarov, N. V. Kordub, Yu. Ye. Klyuchevskiy, A. A. Alimov, and Ye. I. Tret'yakova *In its* Heliotechnology 21 Dec. 1965 p 61–63 refs (See N66-15251 06-03) CFSTI: $3.00

A hexagonal honeycomb thin film faceted solar radiation concentrator is described for use in semiconductor photoconverters which require a concentrated and uniform radiant energy flux. R.N.A.

N66-15264 Joint Publications Research Service, Washington, D. C.

ON AUTOMATING SOLAR UNIT TRACKING

K. Sh. Sharafi *In its* Heliotechnology 21 Dec. 1965 p 64–66 (See N66-15251 06-03) CFSTI: $3.00

Two solar tracking mechanisms designed to maintain the orientation of a solar energy collector are described. Both systems operate on the thermal effect of the sun. The first system consists of two thin walled metal tubes attached to a U-shaped glass tube containing mercury. Electric contacts are located in the glass tube at either end and form open circuits with a motor which can rotate the collector. When the unit becomes disoriented, the sun's rays fall on one of the metal tubes. The gas inside becomes heated, expands, and displaces the mercury towards a contact which closes the circuit and operates the motor to reorient the collector. The second system consists of two blackened bimetallic plates parallel to each other, and fastened on one end. An insulated fork is attached to the free end of one plate with the free end of the other plate inside of the fork. When heated by the sun, the plates drop their free ends closing a contact in the fork which operates the motor and reorients the collector. R.N.A.

N66-15276# Joint Publications Research Service, Washington, D. C.

TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 272

30 Dec. 1965 22 p Transl. into ENGLISH from Chinese Periodicals

(JPRS-33554; TT-65-34128) CFSTI: $1.00

CONTENTS:

1. THE RIVER OUTPOST Ch'ien Chiang p 1–7
2. ACHIEVEMENTS REACHING THE WORLD'S PEAK IN SCIENTIFIC TECHNOLOGY C.-y. Meng p 8–12 (See N66-15277 06-03)
3. THE COOLING OF GENERATORS C. Kan p 13–20 (See N66-15278 06-03)

N66-15277 Joint Publications Research Service, Washington, D. C.

ACHIEVEMENTS REACHING THE WORLD'S PEAK IN SCIENTIFIC TECHNOLOGY

Ch'ing-Yuan Meng *In its* Transl. on Communist China's Sci. and Technol. No. 272 30 Dec. 1965 p 8–12 Transl. into ENGLISH from K'o-Hsueh Hua-Pao (Shanghai), Jun. 1965 p 169–171 (See N66-15276 06-03) CFSTI: $1.00

A brief discussion is given of achievements in China's electrical machinery industry, with emphasis on water cooled generators. Areas covered include a history of the development of cooled generators, and the coordination and cooperation between the technological fields. C.T.C.

N66-15278 Joint Publications Research Service, Washington, D. C.

THE COOLING OF GENERATORS

Ch'un Kan *In its* Transl. on Communist China's Sci. and Technol. No. 272 30 Dec. 1965 p 13–20 Transl. into ENGLISH from K'o-Hsueh Hua-Pao (Shanghai), Jun. 1965 p 171–173 (See N66-15276 06-03) CFSTI: $1.00

Brief consideration is given to electric generator cooling. An elementary explanation of the principle of the turbo-generator is presented, with areas of instability and inefficiencies emphasized. These include losses due to heat and, relative to this, generator cooling. Also included is mention of internal double-water cooling and the advantages of this method. C.T.C.

N66-15307*# Unified Science Associates, Inc., Pasadena, Calif.

GASEOUS ELECTROLYTES FOR BATTERIES AND FUEL CELLS Fourth Quarterly Report, 21 May–20 Aug. 1965

S. Naiditch [1965] 51 p

(Contract NAS7-326)

(NASA-CR-69248) CFSTI: HC $3.00/MF $0.50 CSCL 10A

Cells 52 through 58 and 60 were prepared for measurements. Techniques for the preparation of these cells were varied in order to determine the causes of disturbing effects and to test the performance of cells with different electrolytes. With the exception of cell 53, the electrolytic salt was introduced into a cell only after it was baked out under vacuum. Sodium iodide dissolved in liquid ammonia was used as the electrolytic solution. An attempt was made to pour the salt in air into cell 53 as a dry powder. When this attempt failed, the salt was dissolved in water. The aqueous solution was then transferred into the cell. Subsequently the water was removed by baking under vacuum. Because of the danger of introducing additional contaminants into the cell with this method, and because it did not provide improved performance, its use was discontinued. With cells 58 and 60 an attempt was made to pump off the hydrogen evolved during the decomposition of part of the sodium ammonia solution in the early stage of preparing the cell. This was partially achieved by pumping off the ammonia and hydrogen and refilling the cell with new ammonia. Author

N66-15342*# Livingston Electronic Corp., Montgomeryville, Pa.

DEVELOPMENT OF HIGH ENERGY DENSITY PRIMARY BATTERIES First Quarterly Report, 22 Jun.–21 Oct. 1965

S. G. Abens, T. X. Mahy, and W. C. Merz 28 Dec. 1965 45 p

(Contract NAS3-7632)

(NASA-CR-54859) CFSTI: HC $2.00/MF $0.50 CSCL 10C

Electrolyte and electrode studies for the development of high energy lithium–copper fluoride cells were conducted. Vacuum distillation of propylene carbonate and butyrolactone reduced the water content significantly. Solubility of CuF_2 in butyrolactone was enhanced by the presence of water and by dissolved $LiClO_4$. Studies of CuF_2 purity were undertaken. Electrochemical efficiency of prismatic CuF_2 electrodes of various thicknesses was determined. Author

N66-15365*# Harshaw Chemical Co., Cleveland, Ohio. Crystal-Solid State Div.

RESEARCH AND DEVELOPMENT IN CdS PHOTOVOLTAIC FILM CELLS First Quarterly Report, 28 Jun.–28 Sep. 1965

J. C. Schaefer, E. R. Hill, and T. A. Griffin [1965] 51 p refs (Contract NAS3-7631)

(NASA-CR-54856) CFSTI: HC $3.00/MF $0.50 CSCL 10A

This program is designed to produce CdS solar cells in accordance with the recently proposed solar cell model. Additional model investigations are reported. Vapor transport procedures have been used to produce improved films of CdS. A large improvement has been made in the procedure for forming collector grids by electroplating. This grid technique provides the highest cell stability during thermal cycling. An interface film of silver between substrate and CdS appears to be beneficial. Single crystal Cu_2S has been grown by vapor transport methods. Author

N66-15370*# American Cyanamid Co., Stamford, Conn. Stamford Research Labs.

DEVELOPMENT OF HIGH-PERFORMANCE LIGHTWEIGHT ELECTRODES FOR HYDROGEN–OXYGEN FUEL CELLS Second Quarterly Report, Jul. 6–Oct. 5, 1965

D. Gershberg, W. P. Colman, and J. Di Palma 27 Jan. 1966 66 p refs

(Contract NAS3-6477)

(NASA-CR-54866) CFSTI: HC $3.00/MF $0.75 CSCL 10A

An experimental investigation of the effects of pressure, temperature, and KOH concentration on initial performance was completed. The development of an empirical model relating initial performance to these variables was begun. The evaluation of novel experimental matrices for use at temperatures from 150° to 200° C was continued. Small cell life tests were conducted with asbestos matrices and with several novel types of experimental matrices. Six inch by six inch cells were designed for large cell testing at pressures up to 60 psig and fabrication was scheduled. Initial performance scale-up studies and large cell life testing were conducted in a 6 inch by 6 inch cell previously available. R.N.A.

N66-15375*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.

TWO STAGE POTASSIUM TEST TURBINE Quarterly Progress Report No. 16, 6 Feb.–8 May 1965

E. Schnetzer, ed. [1965] 115 p refs

(Contract NAS5-1143)

(NASA-CR-54643) CFSTI: HC $4.00/MF $0.75 CSCL 10A

Activities are reported on the design and fabrication of a two-stage test turbine suitable for operation in saturated potassium vapor at 1600° F. During this period, the test turbine overhaul was completed and facility modifications for improved operational stability were made. In preparation for performance testing, evaluation of bullet nose annulus flowmeter calibration was completed and improvements in torque measurement were achieved. Tare and performance testing was initiated. A procedure was established to assure stable facility operation. Six performance data points at 1450° F were obtained in 18.8 hours of operation on potassium vapor. The analysis of performance measurements made and the evaluation of these six data points are presented. The data were more consistent than those previously obtained. The test performance data agreed well with the calculated values. The test was terminated because of the failure of a liquid potassium line in the bearing house. The turbine was repaired and is again ready for testing. Additional improvements were effected in reducing zero shift errors in the turbine torque meters. R.N.A.

N66-15376*# New Mexico Univ., Albuquerque. Bureau of Engineering Research.

A THEORETICAL AND EXPERIMENTAL STUDY OF LOW VOLTAGE, HIGH CURRENT DC TO AC CONVERTERS WHICH USE EITHER MAGNETORESISTORS, SUPERCONDUCTORS, HALL EFFECT DEVICES, OR THIN-FILM DEVICES Final Report

Richard Bechtel and W. W. Grannemann Dec. 1965 96 p refs (Grant NsG-279-62)

(NASA-CR-69268; EE-131) CFSTI: HC $3.00/MF $0.75 CSCL 10A

The study of the applicability of magnetoresistors, superconductors, and thin-film field effect devices as controlled rectifiers and multiterminal Hall Effect generators for use in low-voltage, high current direct to alternating current converters is summarized. Also, the design and analysis of associated circuitry for such converters is included. The study of magnetoresistors provided the following: (1) theoretical expressions for magnetoresistance effect and device configurations; (2) indium antimonide as the best room temperature material; (3) bismuth as the best cryogenic temperature material; (4) methods for fabrication of magnetoresistors from these materials. Further, theoretical expressions for the indication of the most important facets of superconductivity, suitable materials for various functions, methods for inducing the switching action, and fabrication techniques were provided by the theoretical and experimental study of superconducting rectifiers. The analytical work on the converter, the feasibility of using switching superconductors as magnetic shields to provide the type of waveform desirable for driving the magnetically controlled rectifier elements of a bridge converter, and the future outlook for the LV-DC controlled rectifier converter are included. E.E.B.

N66-15380*# New Mexico Univ., Albuquerque. Bureau of Engineering Research.

METHODS FOR DC TO AC CONVERSION Semiannual Status Report

Richard Bechtel and W. W. Grannemann Jul. 1965 17 p refs (Grant NsG-279-62)

(NASA-CR-69339; PR-64) CFSTI: HC $1.00/MF $0.50 CSCL 10A

Effort is reported on the establishment of experimental procedures for the study of thin-film devices with application to switching; on the setting up of experimental procedures to investigate the factors affecting the magnetoresistance ratios of bismuth corbino disks formed under varying conditions; setting up the new liquid helium experimental apparatus centered around glass dewar; consideration of initial design for the flux shielding experiments; and continuation of extensive literature search in the field of thin film devices. The metal-oxide-semiconductor (MOS) insulated-gate transistor is discussed and the thin-film deposition for MOS devices is considered. Impurity effects in bismuth corbino disks and new material advances in cryogenics are reviewed. Also, the deposition of niobium films by exploding wire, asymmetric AC-sputtering, bias sputtering and vapor deposition is included. E.E.B.

N66-15406*# National Aeronautics and Space Administration, Washington, D. C.
PROGRESS IN PHOTOVOLTAIC ENERGY CONVERSION
Arvin H. Smith [1965] 50 p refs Presented at the Intern. Energetics Conf., Rochester, N. Y., 18–20 Aug. 1965
(NASA-TM-X-57120) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Developments in the photovoltaic conversion of solar energy are reviewed, and its potential for special purpose terrestrial and rocket vehicle applications is discussed. The availability of solar energy throughout the solar system is examined, and the use of silicon solar cells on the Mariner spacecrafts is described. Details are given on the elements of a typical silicon solar cell, and decreases in cell thickness are discussed, relative to minimum array weight consistent with array area and cost. Growth in photovoltaic power source performance is characterized, and data from 1964 spacecraft launches reveal that oriented photovoltaic array performance ranged between approximately 6 and 10 watts/lb. The problems encountered in accurately determining the space electrical output of solar cells and solar cell arrays, from measurements based on terrestrial sunlight or solar simulators, are analyzed. Electrical design parameters are outlined. The concepts and research involved in developing photovoltaic cell assemblies, concentrator photovoltaics, and high power photovoltaic arrays are also considered. M.G.J.

N66-15436# General Motors Corp., Indianapolis, Ind. Allison Div.
MEASUREMENT OF FLUID PROPERTIES FOR MAGNETOPLASMADYNAMIC POWER GENERATORS Ninth Quarterly Technical Summary Report, 1 May–31 Aug. 1965
Richard T. Schneider and Horst E. Wilhelm 13 Sep. 1965 56 p refs
(Contract Nonr-4104(00))
(EDR-4400; AD-623096) CFSTI: HC $3.00/MF $0.75

A closed loop MPD power generation device was designed, constructed, and operated. Two modes of operation were observed—saturating and nonsaturating. The saturating mode is associated with low seeding ratios while the nonsaturating mode is associated with high seeding ratios and high leakage resistances. During operation, leakage resistances varied between 0.1 and 1.0 megohms. Of the two modes observed, only the saturating mode was investigated thoroughly. The observations were made under the following conditions: pressure slightly above atmospheric, magnetic field up to 21 500 gauss, velocities up to 250 m/sec at the channel entrance, and temperatures (static) up to 1500° K. For the saturating mode at these conditions, no nonequilibrium ionization was observed. Theoretical considerations indicate that to observe nonequilibrium ionization, runs should be made at lower pressures and higher velocities and temperatures than those stated previously. Author (TAB)

N66-15486*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
WEIGHT STUDY OF PARTIALLY SEGMENTED DIRECT-CONDENSING RADIATORS FOR LARGE SPACE POWER SYSTEMS
Roy L. Johnsen Washington, NASA, Jan. 1966 51 p refs
(NASA-TN-D-3227) CFSTI: HC $2.00/MF $0.50 CSCL 10B

An analytical investigation has been performed to provide an insight into the weight increase of a direct-condensing radiator for a potassium Rankine cycle space power system as the system size was increased from 1 to 10 megawatts electric while holding constant the component efficiencies and all cycle temperatures and pressures. The radiator weight is sharply influenced by the meteoroid flux estimate and the design survival probability. For the unsegmented case, using Watson's (1956) flux estimate, the radiator weight ranged from 1.5 to 3 pounds per kilowatt electric for the 1- to 10-megawatt power range for a 0.9 radiator design survival probability, and 2.5 to 6 pounds per kilowatt for a 0.99 design survival probability. When Whipple's (1961) flux estimate was used, the radiator weight ranged from 7 to 17 pounds per kilowatt for a 0.9 design survival probability and from 16 to 42 pounds per kilowatt for a 0.99 design survival probability. Segmentation of the radiator provided significant weight savings over the unsegmented radiator, especially when high survival probabilities were demanded. Generally the weight advantages of segmentation increased with increases in system power level, design survival probability, number of segments, and severity of the meteoroid flux estimate. When Whipple's (1961) meteoroid flux estimate and a 0.99 design survival probability for a 10-megawatt system were used, the radiator with 100 segments was about one-fourth the weight of an unsegmented radiator. Author

N66-15538*# Pennsylvania Univ., Philadelphia. Inst. for Direct Energy Conversion.
THERMOPHYSICAL AND TRANSPORT PROPERTIES OF HIGH TEMPERATURE ENERGY STORAGE MATERIALS
R. A. Sharma and H. Chang [1964] 42 p refs Presented at the 3d Ann. Symp., Tucson, Ariz.
(Grant NsG-316)
(NASA-CR-53807) CFSTI: HC $2.00/MF $0.50 CSCL 10C

The paper describes the prospective thermal energy storage materials and the techniques to be used for the measurements of their thermo physical properties, such as melting points, heats of fusion, and thermal transient transport properties. On the basis of the data available in the literature, several metals and compounds appear to be promising thermal energy storage materials. The suitability of the eutectic mixtures of certain oxides and fluorides is shown by making the estimations of their heats of fusion. Author

N66-15621*# TRW Systems, Redondo Beach, Calif.
STUDY AND ANALYSIS OF SATELLITE POWER SYSTEMS CONFIGURATIONS FOR MAXIMUM UTILIZATION OF POWER Quarterly Progress Report No. 2, 19 Aug.–18 Nov. 1965
W. G. Binckley [1965] 98 p
(Contract NAS5-9178)
(NASA-CR-69440) CFSTI: HC $3.00/MF $0.75 CSCL 10B

The results of the survey of electrical power requirements of typical stabilization and control equipment are tabulated. Stabilization and control systems typically consist of sensors and reaction devices connected through a set of electronics which provides the required data processing and logic functions. A review of the tabulated data indicates the great variety of power requirements imposed by stabilization and control equipment, not only with regard to voltage and voltage regulation, but for ripple and noise as well. Also, the 58 experiments which were reviewed are tabulated in nine basic functional categories which appear to cover the range of nearly all present or anticipated satellite experiments. The electrical power requirements for each of the experiment packages are summarized. It is evident from this data that the standardization of power requirements for scientific experiments should be investigated. The electrical characteristics for eight satellites are also tabulated and block diagrams showing the electrical power system configuration used in each of the eight satellites are included. E.E.B.

N66-15642*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COLD PERFORMANCE EVALUATION OF A 4.59-INCH RADIAL-INFLOW TURBINE DESIGNED FOR A BRAYTON-CYCLE SPACE POWER SYSTEM

Charles A. Wasserbauer, Milton G. Kofskey, and William J. Nusbaum Washington, NASA, Feb. 1966 21 p refs

(NASA-TN-D-3260) CFSTI: HC $1.00/MF $0.50 CSCL 10B

An experimental investigation of a 4.59-inch-diameter radial-inflow turbine was conducted to establish the performance characteristics of radial turbines in this size range. The experimental results are compared with those obtained from a reference turbine of geometrically similar design but with a tip diameter of 6.02 inches. The experimental investigation was conducted in cold argon at the design Reynolds number of 82 200 in order to simulate design hot operation. Tests were made at speeds ranging from 0 to 110 percent of equivalent design speeds and pressure ratios from 1.30 to 2.35. Equivalent specific work and weight flow were 11.7 Btu per pound and 0.605 pound per second at equivalent design speed and pressure ratio. Total and static efficiencies of 0.86 and 0.81, respectively, are approximately 2 points lower than the design values. A radial survey of exit total pressure and flow angle at equivalent design operation indicated a nonuniform work distribution from hub to shroud and amounted to a variation of 10 points in local total efficiency. Comparisons of total and static efficiencies obtained for the two turbines at their respective design Reynolds numbers showed that efficiencies of the subject turbine were approximately 2 points lower than those of the 6.02-inch reference turbine. Author

N66-15728*# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.

APPLICATION OF GALLIUM-ARSENIDE SOLAR CELLS TO SOLAR PROBE POWER SYSTEMS Final Report

30 Sep. 1965 88 p refs

(Contract NAS2-2600)

(NASA-CR-69537; AED-R-2817). CFSTI: HC $3.00/MF $0.75 CSCL 10A

The results indicate that gallium–arsenide solar cells, using suitable temperature control techniques, will be a practical power source for missions with solar approach distances down to 0.07 AU. Closer approaches will be feasible only if area, weight, or cost can be increased beyond those limits which presently appear practical. As solar cell temperature tends to rise with decreasing perihelion, an important part of the effort involved conceptual design of reliable, lightweight, temperature control systems. For each temperature control technique considered, three different types of solar array designs were developed, to independently minimize weight, area, and cost per unit of power. Selected temperature control techniques were considered to correlate system design with distance from the Sun, establishing practical limits for the minimum perihelion. All findings are based upon practical weight, area, and cost considerations for each of the four solar-probe trajectories. However, as realistic values of solar-array temperatures are ultimately dependent upon spacecraft configuration and thermal design, the thermal considerations are subject to modification. Author

N66-15749# Livingston Electronic Corp., Montgomeryville, Pa.

LIQUID AMMONIA BATTERIES Ninth Monthly Progress Report

May 1965 17 p ref

(Contract DA-28-017-AMC-1542(A))

(Rept.-9; AD-624589) CFSTI: HC $1.00/MF $0.50

Twenty-seven single cell tests were conducted utilizing the same general construction parameters as during the last working period except that the rate was reduced from a nominal 100 milliampere drain for the A battery cell to a 50 milliampere rate. Twenty-four single cell tests of the B battery configuration were tested with the primary variations being two types of cathode formulation and various membrane type separators combined with dense separator materials. TAB

N66-15788*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.

DEVELOPMENT OF ELECTRICAL SWITCHGEAR FOR SPACE NUCLEAR ELECTRICAL SYSTEMS Quarterly Progress Report No. 4, 4 Sep.–4 Dec.1965

A. H. Powell, ed. [1966] 65 p

(Contract NAS3-6467)

(NASA-CR-54861) CFSTI: HC $3.00/MF $0.75 CSCL 13G

Detail information is presented under major component headings (interrupter, actuator, test plans, etc.). Engineering design effort has been at a minimum while parts are being built, but appreciable effort was devoted to developing the various assembly techniques and to detailing the test specifications and procedures. There have been no insurmountable problems, and while deliveries of some vital parts such as springs, flexurals, and ceramic assemblies have held up certain assembly starting dates, the end dates for test completion appear attainable. A detail study of facilities for the interruption (electrical) testing has resulted in a decision to make these tests at SPPS. With this change it will be possible to utilize a vacuum tank which is available so that with a minimum facility expenditures, realistic (in vacuum) tests can be conducted. Author

N66-15794*# Leesona Corp., Great Neck, N. Y.

THE IMPROVEMENT OF ZINC ELECTRODES FOR ELECTROCHEMICAL CELLS

J. E. Oxley Washington, NASA, Feb. 1966 37 p refs

(Contract NAS5-3908)

(NASA-CR-377) CFSTI: HC $2.00/MF $0.50 CSCL 10C

The requirement for higher energy outputs per unit weight of battery in advanced space missions has pointed out the need for developing the Ag/Zn battery into a more reliable, rechargeable battery. The major obstacle which presently prevents an improvement beyond this figure for the Ag/Zn secondary battery is the deterioration of the zinc electrode which occurs during recharging by the formation of dendrites on the Zn negative plate. These dendrites are associated with the fact that zinc is quite soluble in the electrolyte, and that during the charging and discharging of Zn electrodes, extensive rearrangements of the Zn physical form occur. Two main parameters which control dendrite growth have been identified. These are: (1) the overpotential which governs the morphology, and (2) the rate and type of zincate diffusion (i.e., spherical or linear) in relation to the geometry of the electrode/electrolyte interface, which controls both the overall growth rate and the selective propagation of individual dendrites. It was shown that density differences between zincate and potassium hydroxide, and hydrogen bubble formation both lead to local convection and thereby enhanced propagation. Author

N66-15812*# Thermo Electron Engineering Corp., Waltham, Mass.

FINAL DESIGN DOCUMENTATION FOR SIX-CONVERTER THERMIONIC GENERATOR DESIGN

P. J. Brosens Oct. 1965 176 p Prepared for JPL

(Contracts NAS7-100; JPL-951230)

(NASA-CR-69567; TE-18-66) CFSTI: HC $5.00/MF $1.00 CSCL 10B

Presented is the final design documentation for a six-converter solar thermionic generator with simplified cavity geometry. A computer program was used to compute the solar flux in the generator cavity and the actual amount of solar radiation that reached each individual cavity element. The final design layout of the electron bombardment unit of the generator increased the central filament support structure to 0.030 inch from a previous value of 0.015 to minimize heat losses. G.G.

N65-15889# Naval Air Development Center, Johnsville, Pa. Aero-Electronic Technology Dept.
DEVELOPMENT OF VARIABLE PARAMETER POWER SOURCE Progress Report
James R. Garnett 14 Oct. 1965 17 p refs
(NADC-AE-6508; AD-473336)

A breadboard clipping circuit was designed and constructed. The harmonic content of the output voltage was measured and tabulated. The measured and theoretical values were adequate to justify the design procedure. Author (TAB)

N66-15969# Frankford Arsenal, Philadelphia, Pa. Propellant Actuated Devices Div.
QUALIFICATION OF THRUSTER, CARTRIDGE ACTUATED, XM25
Roger L. Schultz Nov. 1965 30 p refs
(R-1781; AD-624425) CFSTI: HC $2.00/MF $0.50

Product improvement of the M20 thruster was performed to prevent premature release of the thruster piston (resulting from shock and impact) and rotation of the piston with respect to the body. The redesigned thruster was designated 'Thruster, Cartridge Actuated, XM25.' The thruster contains the M127 cartridge used in the M20 thruster. The report describes the engineering test program conducted, the results obtained, and an analysis of the results, which shows that all applicable specifications and requirements have been met. Further, it is recommended that this item be standardized and that it replace the M20 thruster. Author (TAB)

N66-16047*# Goodyear Aerospace Corp., Akron, Ohio.
CONE AND COLUMN SOLAR CONCENTRATOR MODEL Final Report
Thomas J. Mc Cusker Jul. 1965 214 p refs
(Contract NAS1-4341)
(NASA-CR-66012; GER-12268) CFSTI: HC $6.00/MF $1.50 CSCL 10B

Analysis of the cone and column solar concentrator establishes the design feasibility for a 60 foot diameter model. A specific weight of 0.2 pounds per sq. ft. and packaging in a 9 foot diameter appear to be attainable objectives. A cone construction was developed consisting of conical film sectors with film stiffeners attached to the outside surface. The construction of a 5 foot diameter preprototype optical model concentrator is described. Author

N66-16056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD PERFORMANCE EVALUATION OF A 6.02-INCH RADIAL INFLOW TURBINE DESIGNED FOR A 10-KILOWATT SHAFT OUTPUT BRAYTON CYCLE SPACE POWER GENERATION SYSTEM
Milton G. Kofskey and Donald E. Holeski Washington, NASA, Feb. 1966 25 p refs Revised
(NASA-TN-D-2987, Rev.) CFSTI: HC $1.00/MF $0.50 CSCL 10B

A 6.02-inch tip diameter radial inflow turbine was designed and fabricated for a space power application with argon as the working fluid. A cold argon and air performance evaluation was made over a range of pressure ratios and speeds. The experimental investigation consisted of two phases, tests in argon and air at a high Reynolds number of 225 000 (approximately four times design) and tests in argon at a design Reynolds number of 63 700. Results of the initial investigation, at the Reynolds number of 225 000, indicated that the equivalent turbine performance was essentially the same using cold argon or air as the working fluid. The total and static efficiencies obtained at equivalent design speed and design blade- to jet-speed ratio (0.697) were 0.90 and 0.84, respectively. Final tests were made in argon at the design Reynolds number of 63 700 in order to establish the efficiency level at this value. Results at design blade- to jet-speed ratio indicated total and static efficiencies of 0.88 and 0.83, respectively. Comparison of results obtained at high and design Reynolds numbers indicated a 2.0 point decrease in total efficiency and a 1.0 percent reduction in equivalent weight flow at design Reynolds number. Author

N66-16139*# Globe-Union, Inc., Milwaukee, Wis.
A PROGRAM TO DEVELOP A HIGH-ENERGY DENSITY PRIMARY BATTERY WITH A MINIMUM OF 200 WATT HOURS PER POUND OF TOTAL BATTERY WEIGHT Sixth Quarterly Report, Oct. 1–Dec. 31, 1965
William E. Elliott, James R. Huff, Gerald L. Simmons, Guy D. Mc Donald, Judith L. Jamrozy et al 15 Jan. 1966 154 p
(Contract NAS3-6015)
(NASA-CR-54873) CFSTI: HC $5.00/MF $1.00 CSCL 10C

Litnium anodes, inorganic and organic cathodes, vacuum-distilled solvents, and various methods of sintering cupric fluoride on lightweight metal substrates were studied in connection with a program to develop a high energy density primary battery. The difference in electrochemical performance in dried and undried $LiPF_6$ in N-nitrosodimethylamine was found to be slight; performance in dimethylformamide was superior for the undried $LiPF_6$ over the dried electrolyte. Pressed inorganic cathodes with conductive additives and binders were fabricated from various fluoride salts and other compounds. Both inorganic and organic cathodes were evaluated in half-cell screening tests, coulombic efficiency tests, and linearly varying potential scans. Measurements of specific conductivity and refractive index of vacuum-distilled solvents was continued. Stability tests were made for lithium and calcium in electrolytes pretreated with the anode material. M.W.R.

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N66-15204# Cornell Univ., Ithaca, N. Y. Dept. of Zoology.
TEMPERATURE REGULATION IN THE VAMPIRE BAT *DESMODUS ROTUNDUS* Interim Report, Sep. 1963–Jun. 1964
Charles P. Lyman and William A. Wimsatt Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Sep. 1965 19 p refs
(Contract AF 41(609)-2296; Grant NSF G-2403)
(AAL-TR-64-36; AD-624043) CFSTI: HC $1.00/MF $0.50

Body temperature and oxygen consumption were measured at various environmental temperatures in a series of captive and wild caught vampire bats, Desmodus rotundus. The response to

changes in ambient temperatures was unpredictable and could not be correlated with the age or sex of the animals, their nutritional condition, or the length of their captivity. Body temperature varied greatly, but generally did not fall below 30° C when the ambient temperature was above 25° C. At lower ambient temperatures, some bats increased their metabolism and maintained a high body temperature for varying periods, while others showed little or no increase in metabolic rate, and their body temperatures declined. Below about 20° C body temperature, bats were unable to rewarm themselves without exogenous heat. Calculations indicate that vampires did not drink sufficient blood to maintain a homeothermic condition at the temperatures of temperate zone hibernacula. Bats could tolerate ambient temperatures of 33° C or more for only short periods. It is suggested that Desmodus is limited from spreading northward because of its inferior temperature regulation.
Author (TAB)

N66-15205# Duke Univ., Durham, N. C. Dept. of Anatomy.
HISTOLOGIC STUDY OF THE EFFECTS OF PROFOUND HYPOTHERMIA ON SPINAL CORD OF THE DOG Interim Report, Jun. 1963–Sep. 1964
Charlene M. Nelson, Talmage L. Peele, Maurice A. Lesage et al Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Aug. 1965 38 p refs
(Contract AF 33(637)-9629)
(AAL-TR-64-35; AD-624042) CFSTI: HC $2.00/MF $0.50

A study was made of the microscopic effects of profound hypothermia on spinal cord of the dog. Samples of cervical, thoracic, lumbar and sacral cord levels of three normal and eight experimental dogs were examined. In the experimental sections the axons and myelin were apparently unaltered, and the number of anterior horn cells was within normal limits. Changes in the experimental sections included the appearance of slight to moderate chromatolysis, hyperchromic, pyknotic neurons, and most commonly, gliosis, which was more evident in the lumbar and sacral cord levels. The findings of the present study were in agreement with the results other authors have reported in studies on ischemia by vascular occlusion. Although the alterations found in the spinal cords of the experimental dogs were not extensive, it is believed that these animals had been subjected to a condition of mild ischemia. Author (TAB)

N66-15221# Harvard Univ., Boston, Mass. Dept. of Dermatology.
MOLECULAR STRUCTURE AND DIFFUSIONAL PROCESSES ACROSS INTACT EPIDERMIS Final Comprehensive Summary Report, Jul. 1964–Jul. 1965
Robert J. Scheuplein [1965] 70 p refs
(Contract DA-18-108-AMC-148(A))
(AD-621078) CFSTI: HC $3.00/MF $0.75

The penetration rate for small molecular weight alcohols is approximately given by the expression: $Js = Kp\ Km\ dCs$, where $Kp = 0.001\text{-}3$ cm/hr. is essentially the permeability constant for water in the membrane. Km is the membrane-water partition coefficient for the alcohol and dCs is the concentration difference across the membrane. The activation energy for the penetration water and the polar alcohols, through hydrated stratum corneum is approximately 15 Kcal/mole. Extensive immersion in water effects the 'barrier' function of stratum corneum only slightly; principally by opening 'pores' which contribute to the diffusion a parallel flux which is relatively small above room temperature. Penetration through the stratum corneum is not primarily intercellular or appendageal. The hydrated stratum corneum seems to be best described as a dense, effectively homogeneous phase into which small molecular weight polar non-electrolytes dissolve with strong chemical interaction and through which diffusion occurs remarkably slowly. Author (TAB)

N66-15239*# Miami Univ., Coral Gables, Fla.
EXPERIMENTS SUGGESTING EVOLUTION TO PROTEIN
Sidney W. Fox (Florida State Univ.) [1964] 20 p refs
(Grant NsG-689)
(NASA-CR-59829) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Studies of the organismic evolution of proteins began with application of sequential and terminal residue methods to trace the evolution of the primary structure of protein particles. Among the evolved concepts were a Darwinian explanation of microheterogeneity of protein preparation and evidence of genealogical relations of proteins. The latter led to experiments to test the effect of sufficient proportions of glutamic acid, glutamine, aspartic acid, and asparagine on the anhydrocopolymerization of amino acids. It was found that clean polymers could be produced by dry heating mixtures of eighteen amino acids common to protein. These protenoids are compared with contemporary proteins by reference to numerous research studies which demonstrate the similarity of poly-α-amino acid to protein, and experiments can approach the viable contemporary cell. It is considered that the dilemma concerning the evolutionary pathway to the first protein, and to a precellular form, has been solved in principle. M.W.R.

N66-15240*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE IONIZING RADIATIONS IN SUPERSONIC TRANSPORT FLIGHTS
Trutz Foelsche [1964] 23 p refs Presented at the 2d Symp. on Protect. against Radiation in Space, Gatlinburg, Tenn., 12–14 Oct. 1964
(NASA-TM-X-56135) CFSTI: HC $1.00/MF $0.50 CSCL 06R

Commercial supersonic transport planes are envisioned to cruise at altitudes up to 23 km or 75,000 feet. The exposure to crew and passengers from Galactic and Solar Cosmic Rays at these altitudes on polar routes is estimated and compared with the maximum permissible dose rates (MPD) cited in the guide lines of the Federal Radiation Council or the International Commission for Radiation Protection. The dose equivalent in rem from Galactic Cosmic Radiation at cruise altitudes on polar routes is estimated as ≤ 2 mrem/hr. This implies that the crew should experience ≤ 20 percent of the MPD for radiation workers (5 rem/year), at 20 hours/week flight duty or 10 hours in 23 km altitude, if evasive measures during intense and energetic solar flare events are taken. The above dose rate from Galactic Cosmic Rays is considered as an upper limit because the fast neutron flux and the buildup factors of secondaries in the airplane are assumed conservatively high. Author

N66-15245*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INCORPORATION OF PROTEIN AND NUCLEIC ACID PRECURSORS INTO FROG NERVOUS TISSUE IN VITRO
Jacob Shapira, Peter C. F. Castellani, and Johnnie O. Coleman [1964] 14 p refs Submitted for Publication
(NASA-TM-X-54943) CFSTI: HC $1.00/MF $0.50 CSCL 06A

In vitro observations were made of the effects of 1,1,3-tricyano-2-aminopropene (TCAP) on the incorporation of protein and nucleic acid precursors into central and peripheral nervous tissue of the frog. It was found that TCAP inhibited C^{14}-valine incorporation into the protein fraction of both types of tissue; whereas H^3-uridine incorporation into RNA

was inhibited only in the brain tissue. Changes in nucleic acid metabolism of frog ganglia were quite similar to those produced by DNP and azide. Initial experiments, to determine whether tissues were able to incorporate significant amounts of radioactivity during an 18-hour incubation period, showed that H^3-uridine, H^3-cytidine, C^{14}-adenine, C^{14}-guanine, and C^{14}-valine were incorporated in easily determinable amounts; while H^3-thymidine was not since the tissues were not engaged in the formation of new DNA. Only a negligible amount of radioactivity from the other precursors was incorporated into the DNA. Dual labeling experiments with H^3- and C^{14}-precursors were also undertaken. It was necessary to phosphorylate the precursors before they could be incorporated into RNA; and there is some evidence that TCAP has an effect on oxidative phosphorylation and the formation of ATP. M.W.R.

N66-15260 Joint Publications Research Service, Washington, D. C.

HELIOTHERAPY DEVICE USING COMBINED ACTION OF TOTAL AND DIFFUSE SOLAR RADIATION

V. S. Svarichevskiy *In its* Heliotechnology 21 Dec. 1965 p 45–49 refs (See N66-15251 06-03) CFSTI: $3.00

Several louvered and pierced sun screens designed to eliminate the harmful effects of overexposure to the sun while making the fullest use of bright sunlight are described. These devices, used in heliotherapy, are discussed in terms of their advantages and disadvantages. R.N.A.

N66-15272 Joint Publications Research Service, Washington, D. C.

CYBERNETICS IN PLANT-GROWING

N. Bolgarov *In its* News of Soviet Cybernetics 29 Dec. 1965 p 6–8 (See N66-15270 06-34) CFSTI: $1.00

The use of cybernetic systems for the control of physiological factors in plant growing are discussed. An experiment in which a plant was forced to establish during artificial illumination the duration of "day" and "night" is reported. The plant, interacting with automatic machines, switched on and off the light itself when necessary. The sum of hours of light and darkness turned out to be close to the duration of the solar day. Experiments of automatic watering on commands of the plant are also reported. M.R.W.

N66-15381*# Public Health Service, Washington, D. C. Div. of Environmental Engineering and Food Protection.

ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Second Quarterly [Progress] Report, Jul. 1–Sep. 30, 1965

Robert Angelotti, Herbert E. Hall, James H. Maryanski, Ronald G. Crawford, Ralston B. Read et al Oct. 1965 23 p refs (NASA Order R-36)

(NASA-CR-69345) CFSTI: HC $1.00/MF $0.50 CSCL 06F

Data are presented indicating that *Bacillus globigii* spores are recoverable from experimentally contaminated blocks of balsa wood by maceration in a Waring Blendor. A technique has been developed whereby spores introduced into aceton soluble plastics may be recovered quantitatively by means of dissolution and entrapment in Seitz filter pads. In connection with the development of a satisfactory model system for insoluble components, a method has been developed which provides quantitative information on the toxicity of plastics. This technique utilizes the concept of the direct surface agar plate which has found wide application in the field of surface contamination. Author

N66-15394*# Institute for Behavioral Research, Inc., Silver Spring, Md.

EXPERIMENTAL STUDIES OF PERCEPTUAL PROCESSES, SECTION TWO Progress Report, Jan. 1–Sep. 30, 1965

Charles B. Ferster, John Randolph, and Clifford Hammer Sep. 1965 54 p refs (Grant NsG-450)

(NASA-CR-69356) CFSTI: HC $3.00/MF $0.50 CSCL 05J

The development of special environmental and concomitant behavioral techniques necessary for experiments on complex repertoires and the kinds of complex cognitive repertoires developed were previously presented. The complex performances developed over the past three years were used as tools for the evaluation of schedules and kinds of reinforcement and special contingencies to control error rates and the overall rate of responding. The most complex matching-to-sample task developed was one in which the chimp matched binary numbers to a stimulus consisting of a display of geometric figures varying in form and spatial distribution. The chimp selected one of two binary numbers which corresponded to the number of items in the sample. New kinds of stimulus control were developed in other experiments in which the animal actually produced the binary stimulus. Complex discrimination behavior in chimpanzees, fixed ratio reinforcement of large units of behavior, and deferred reinforcement are the three major subjects presented. E.E.B.

N66-15395*# Institute for Behavioral Research, Inc., Silver Spring, Md.

EXPERIMENTAL STUDIES OF PERCEPTUAL PROCESSES, SECTION THREE Progress Report, Jan. 1–Sep. 30, 1965

Israel Goldiamond, John Thomas, Stanley Pliskoff, Albert Miller, John Quagliano et al Sep. 1965 87 p refs (Grant NsG-450)

(NASA-CR-69357) CFSTI: HC $3.00/MF $0.75 CSCL 05J

A series of experiments which are part of a program in which procedures derived from operant research are extended to relevant problems in signal detection research and in which procedures derived from signal detection research are extended to the design of experiments in relevant operant areas are reported. Operant research has developed refined procedures relating reinforcing and aversive consequences to behavior. Such procedures have been built into the cells of the decision matrices of signal detection research. Procedures for establishing and maintaining complex behaviors have also been included. Signal detection research programs its systematic relation of pay-offs to behavior in a manner which differs from the systematic relation obtaining in operant research. Some operant experiments were designed in terms of the refined decision framework of signal detection. Signal detection psychophysical research, application of the theory of signal detection to the design and analysis of operant conditioning experiments, and experiments in visual phenomena are included. E.E.B.

N66-15396*# Institute for Behavioral Research, Inc., Silver Spring, Md.

EXPERIMENTAL STUDIES OF PERCEPTUAL PROCESSES, SECTION FOUR Progress Report, Jan. 1–Nov. 30, 1965

Robert G. Grenell, John Thomas, Alan Stubbs, and Israel Goldiamond Sep. 1965 47 p refs (Grant NsG-450)

(NASA-CR-69358) CFSTI: HC $2.00/MF $0.50 CSCL 06A

Progress is reported on the neurobiological program concerned with a specification of particular neurochemical correlates of such behavioral phenomena as learning and memory.

The behavioral aspects of the neurobiological program and the neurochemical aspects of the program are summarized. A current series of research has involved the use of rats that have been maintained on a chronic injection program for extended time periods. The rats were injected chronically with TRIAP, a substance known to alter RNA in neurons and glia. The rats were trained on several different behavioral baselines and their terminal performances were compared to normal subjects on the same baselines. The determination of nucleic acid content and base composition by biochemical method was performed on specific cellular structures isolated by microdissection. The nucleic acids are extracted from these structures and analyzed under defined physicochemical conditions. Microelectrophoresis was employed for the determination of nucleic acid base composition. E.E.B.

N66-15431# Massachusetts General Hospital, Boston. Stanley Cobb Labs. for Psychiatric Research.

RESEARCH ON INFORMATION PROCESSING IN THE CENTRAL NERVOUS SYSTEM Scientific Report No. 1

Frank R. Ervin 23 Jul. 1965 26 p refs

(Contract AF 19(628)-408)

(AFCRL-65-580; AD-621277) CFSTI: HC $2.00/MF $0.50

A system of automatic receptive field mapping for visual cortical neurons by a digital computer. It consists of (1) stimulus display by a digital CRT, simultaneous data sampling and on-line data processing into a post-stimulus time histogram and an averaged evoked potential, and (2) offline readout of numerical values and tabulation. Several problems lying between the neurophysiological or statistical nature of the response and data processing techniques are also described and discussed. Author (TAB)

N66-15435*# Naval School of Aviation Medicine, Pensacola, Fla.

THE EFFECTS OF VISUAL DEPRIVATION ON ADAPTATION TO A ROTATING ENVIRONMENT

Robert S. Kennedy, Gilbert C. Tolhurst, and Ashton Graybiel 18 Mar. 1965 43 p refs *Its* Rept.-106

(NASA Order R-93)

(NASA-CR-69359; NSAM-918) CFSTI: HC $2.00/MF $0.50 CSCL 06S

Visual factors play a significant role in adapting to a rotating environment. The lack of visual information appears to minimize the symptomatology of vestibular sickness. In addition, performance during rotation, on tests of postural equilibrium, is at least as good and improvement is probably more rapid in an individual who is visually deprived. Reduction in the magnitude of the Coriolis illusion as a function of time under rotation occurs whether vision is permitted or denied, but is more variable in the latter condition. In addition, the post-adaptation Coriolis illusion was absent following the no-vision rotation condition. It was evident, however, when visual information was available during rotation; and this might indicate that adaptation which occurred with vision was "deeper." Contiguous (four days or less) duration exposures show evidence that adaptation is more easily attained on the second exposure, thus indicating a transfer of training. Little, if any, transfer appears when exposures are 30 days apart. Author

N66-15456 Joint Publications Research Service, Washington, D. C.

AGROMETEOROLOGICAL INDICES OF FLAX-FIBER GROWTH

L. V. Andrianova *In its* Soviet Studies in Meteorol. and Hydrol. 21 Dec. 1965 p 47-54 refs (See N66-15451 06-13) CFSTI: $3.00

The biological characteristics of flax fiber are summarized, and the influence of such meteorological factors as temperature, soil, and air moisture on the yield and quality of the fiber is discussed. Tabulated data show the difference in the development of the morphological indices of the stem as a function of different agrometeorological conditions during the critical period. Details are also given on various field experiments. Findings indicate (1) the importance of moisture reserves in the soil; (2) the relationship between the duration of the sprouting-flowering period and meteorological conditions; and (3) the dependence of plant height on moisture supply in the tilled soil layer. M.G.J.

N66-15465# Joint Publications Research Service, Washington, D. C.

A BIOLOGY OF ACTIVITY: THE ROLE OF CYBERNETICS IN BIOLOGY

N. A. Bernshteyn 29 Dec. 1965 30 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 10, 1965 p 65-78

(JPRS-33518; TT-65-34092) CFSTI: $2.00

The rapidly changing viewpoints and the many developments in the area of the biological sciences are discussed in conjunction with the need to reexamine and reinterpret older methodologies and concepts. The classical reflex theory is reviewed, and the relationships of the whole and part in the development and behavior of the organism is considered. The research problems directly connected with the study and mathematical modeling of the basic categories of physiological variables, and their participation and interaction in the control of vital activities, are analyzed. The conclusion was drawn that in mathematizing the biological sciences, acclimatization or addition of mathematics to biology should not be superimposed from the outside; rather, new biological methods of mathematics should be cultivated from the inside, based on the problems posed by the sciences dealing with life. M.G.J.

N66-15474# Joint Publications Research Service, Washington, D. C.

REGULATIONS ON RADIATION SAFETY DURING GAMMA RAY DEFECTOSCOPY

28 Dec. 1965 29 p Transl. into ENGLISH from Durzhaven Vestn. (Sofia), no. 95, 3 Dec. 1965 p 1-7

(JPRS-33502; TT-65-34076) CFSTI: $1.00

The regulations governing the design, production, and use of all types of gamma defectoscopes in Bulgaria are defined. These cover the requirements for (1) the design of new laboratories, and the rebuilding of existing ones; (2) the location of the laboratory, and the construction of the rooms; (3) mobile defectoscope operations in open areas, general shops, etc., where the work areas must be protected; (4) protection against gamma radiation in the laboratory; including recommendations for safety norms and dosimetric control; (5) general requirements and basic regulations for safety techniques during operation; (6) medical control of personnel; and (8) administrative responsibilities and penalties. Data are also included on radioactive isotopes used in gamma defectoscopy, and on the distances at which the dose power drops down to 0.1 m/hr when the beam is directed vertically downwards. M.G.J.

N66-15512# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (West Germany). Institut für Flugmedizin.
PAPERS OF DVL-INSTITUTE FOR AEROMEDICINE AT VIth INTERNATIONAL AND XIIth EUROPEAN CONGRESS OF AVIATION AND SPACE MEDICINE IN ROME 1963 AND XIIth INTERNATIONAL CONGRESS OF AVIATION AND SPACE MEDICINE IN DUBLIN 1964 [VORTRAGE AUS DEM INSTITUT FUR FLUGMEDIZIN GEHALTEN AUF DEM VI. INTERNATIONALEN UND XII. EUROPAISCHEN KONGRESS FUR LUFT- UND RAUMFAHRT MEDIZIN IN ROM 1963 UND DEM XIII. INTERNATIONALEN KONGRESS FUR LUFT- UND RAUMFAHRTMEDIZIN IN DUBLIN 1964]
W. Briegleb Sep. 1965 48 p refs In GERMAN; ENGLISH and FRENCH Summaries
(DLR-FB-65-40; DVL-431) CFSTI: HC $2.00/MF $0.50

This report includes 7 papers presented by members of the DVL-Institute for Aeromedicine at the VIth International and XIIth European Congress of Aviation and Space Medicine 1963 in Rome and at the XIIIth International Congress of Aviation and Space Medicine 1964 in Dublin. The different subjects of the papers are: therapy against decompression sickness, adaptation to an "unspecific stress", the mechanism of the serous stress reaction, the biochemical primary effects in radiation damage, clinical picture of the shifted diurnal rhythm during jet flights, explosion and decompression injuries, and the influence of weightlessness on cell function. Author

N66-15552# Manitoba Univ., Winnipeg. Dept. of Psychology.
BIBLIOGRAPHY OF STUDIES ON SENSORY DEPRIVATION AND RELATED CONDITIONS
John P. Zubek, Doris Dobbs, and Louis Bayer [1965] 31 p refs
(Grant NIH G-MH-08748-01) CFSTI: HC $2.00/MF $0.50

A bibliography is presented on studies on sensory deprivation and related conditions. References are included on perceptual deprivation, sensory isolation, sensory invariance, stimulus deprivation, patterned stimulation, confinement, social isolation, monotony, effects of early experiences in humans and animals, and brainwashing. R.N.A.

N66-15579*# Baylor Univ., Houston, Tex. College of Medicine.
AUDITORY MASKING: A STUDY OF ITS PHYSIOLOGICAL MECHANISM AND OF CORRELATIONS BETWEEN PHYSIOLOGICAL AND PSYCHOLOGICAL OBSERVATIONS First Quarterly Progress Report, Period Ending 30 Jun. 1965
Peter Kellaway and A. C. Coats [1965] 20 p
(Grant NsG-390)
(NASA-CR-69426) CFSTI: HC $1.00/MF $0.50 CSCL 05J

Psychological data in the following areas was accumulated: the time course of recovery of masked click threshold following cutoff of the masking stimulus, the effect of masking duration, and the effect of masking intensity. Results in these areas and the observed similarities and differences with comparable physiological observations are discussed. Also, control experiments to determine the effect of a warning flash on the recovery click threshold are discussed. Further physiological studies include masked and unmasked click input–output curves and the effect of masking intensity utilizing white noise instead of pure tones. Author

N66-15580*# Naval School of Aviation Medicine, Pensacola, Fla.
VISUAL LOCALIZATION OF THE HORIZONTAL AS A FUNCTION OF BODY TILT UP TO ±90° FROM GRAVITATIONAL VERTICAL
Earl F. Miller, II, Alfred R. Fregly, Gert van den Brink, and Ashton Graybiel 3 Aug. 1965 25 p refs *Its* Rept.-118
(NASA Order R-47)
(NASA-CR-69927) CFSTI: HC $2.00/MF $0.75 CSCL 06S

The visual horizontal was determined for three sophisticated subjects tilted laterally in 10° intervals within ±90° from gravitational vertical. The task had adequate intratest reliability, but there were considerable intertest and intrasubject quantitative variations. Visual localization as a function of body tilt, however, was qualitatively similar among all subjects and among the thirteen test sessions of each subject. Around upright there was a range (totaling 20°–40° on the average) of body positions in which the deviation was not significant from that of upright. Inclinations beyond this range caused the E-phenomenon to appear and increase bilaterally up to a maximum of about the 40°–50° position; with further inclination the deviation reversed direction and passed through the position (60°–80°) of zero deviation to grow as the A-phenomenon. Responses were bilaterally symmetrical in certain respects for each of the subjects. The variable error among all subjects followed a similar (curvilinear) function of body attitude. Repetition of the test without immediate knowledge of results did not as a rule end in reduction of errors. Author

N66-15635*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE HUMAN PARAMETER IN SPACE FLIGHT A State-of-the-Art Review
Mitchell R. Sharpe, Jr. 19 Jul. 1963 67 p refs
(NASA-TM-X-57119; MTP-M-MS-IS-63-1) CFSTI: HC $3.00/MF $0.75 CSCL 06S

The role of man as an integral part of a spacecraft is discussed from the viewpoint of his physiology and the ambient space environment. The deleterious effects of this environment upon him and the measures necessary to keep him alive in it are also reviewed. The known as well as the unknown hazards are treated briefly. An appendix summarizes the cyborg concept, which is often proposed as an alternative to human space travel. Author

N66-15655# Aerojet-General Corp., Dayton, Ohio. Life Support Systems Div.
TOXIC HAZARDS RESEARCH UNIT—DESIGN AND CONSTRUCTION PHASE
J. D. MacEwen Wright-Patterson AFB, Ohio. AMRL Sep. 1965 111 p *Its* Rept.-3024
(Contract AF 33(657)-11305)
(AMRL-TR-65-125; AD-624473) CFSTI: HC $4.00/MF $0.75

A facility was designed and constructed at Wright-Patterson Air Force Base for the specific purpose of conducting inhalation toxicology research. This facility is unique in that it has considerable functional variability and may be used for the study of space cabin toxicity under altitude and 100% oxygen conditions. Additionally, the laboratory was designed for use as a standard inhalation toxicology laboratory for the study of Air Force materials which may constitute a hazard to ground support personnel. This report describes the design and functional capability of the toxic hazards research unit laboratory which became operational in September of 1964. Toxicology research of the nature described has been initiated and will be reported upon as individual experiments are completed. Author (TAB)

N66-15672# Brussels Univ. (Belgium).
RESEARCH INTO NEW MEANS OF DIAGNOSIS AND TREATMENT BY METHODS DERIVED FROM NUCLEAR TECHNIQUES [RECHERCHE DE NOUVEAUX MOYENS DE DIAGNOSTIC ET DE TRAITEMENT A L'AIDE DE METHODES DERIVEES DE TECHNIQUES NUCLEAIRES] Annual Report
1965 53 p refs In FRENCH and ITALIAN; ENGLISH summary Prepared jointly with Pisa Univ.
(EURATOM-026-63-4 BIAC)
(EUR-2414.f,i) CFSTI: HC $3.00/MF $0.50

The first results obtained from this research include the planning and final work on: (1) analog models of the metabolism of phospholipides and proteins; (2) a clinical absorption test on I^{125} and I^{131} labelled fats; (3) external measuring renal excretion with I^{125} hippurane; (4) measurement of coronary flow using external and internal counting (Rb_{85}-Kr_{87}); (5) Measuring cerebral circulation (Kr_{85}); (6) detection of cancers and cancerous metastases by external counting (I^{131} fibrinogen); (7) measuring *in vitro* glucosated catabolism (C_{14} glucose); (8) methods for dosing erythropoietin, insulin and thyreotropic hormone; (9) double labelling with I^{125} and I^{131} and isotopic equilibrium in the diagnosis of thyroid disorders; and (10) neutron activation dosing of urinary, plasmatic, and thyroidal iodine and tissue ions in muscular biopsies.
Author

N66-15734# National Defense Research Organization T.N.O., The Hague (Netherlands). Medical Biological Lab.
CONTINUED IMMUNOLOGICAL TOLERANCE IN MICE, INDEPENDENT OF ANTIGEN EXCESS
O. B. Zaalberg and V. A. van der Meul 1965 40 p refs Sponsored by EURATOM
(MBL/1965/24; TDCK-43736) CFSTI: HC $2.00/MF $0.50

The specific immunological tolerance of donor cells towards the host tissue antigens in allogeneic mouse irradiation chimeras was investigated. It has been shown that transfer of bone marrow cells from these chimeras into irradiated mice of the original bone marrow-donor strain results in a loss of tolerance. However, transfer of spleen cells or bone marrow cells together with lymph node cells results in a prolonged state of tolerance towards the tissue antigens of the first host, as could be demonstrated with skin-grafts. These transfer experiments make it probable that for the maintenance of the tolerance within the lymphatic cell population no antigens are necessary. Mice inoculated with a tolerant lymphatic cell population sometimes lose tolerance, which is ascribed to a gradual replacement of the tolerant population by nontolerant cells originating from the transferred bone marrow. Thymectomy was therefore used as a method of preventing the transferred bone marrow from replacing the transferred tolerant population of lymphatic cells. Thymocytes were only effective to maintain the tolerant state when they were transplanted into thymectomized hosts.
Author

N66-15739# Joint Publications Research Service, Washington, D. C.
STUDIES IN REACTIVITY OF THE CARDIOVASCULAR SYSTEM
S. V. Andreyev and Yu S. Chechulin 13 Jan. 1966 26 p Transl. into ENGLISH from the book "Ocherki po Reaktivnosty Serdechnososudistoy sistemy" Moscow, Publishing House "Meditsina", 1965 p 329–346 370–372
(JPRS-33717; TT-66-30161) CFSTI: $1.00

The factors affecting cardiovascular reactivity are discussed, based on data obtained from experiments and from a literature review of the subject. Particular attention is given to the phylo- and ontogenetic characteristics, and the influence of such factors as climate, pharmacological agents, body temperature, infectious processes, endocarditis, hypertension, and pathological conditions. Vascular reactivity in atherosclerosis, angina pectoris, and myocardial infraction are also considered. From the factual material surveyed, cardiovascular reactivity was tentatively defined as the main biological property of the cardiovascular system, consisting essentially of prompt and adequate change in cardiac activity, vasomoter activity, and vascular tone in response to influences from the social and biological environment. It was also pointed out that cardiovascular reactivity differs from variability and individual characteristics including hereditary ones. The recommendation was made that experimental investigations consider inadequate, distorted, and paradoxical reactions of the myocardium and blood vessels when using drugs and other therapeutic measures.
M.G.J.

N66-15743# Joint Publications Research Service, Washington, D. C.
ON THE PREREQUISITES AND PARTICULAR FEATURES OF CONSCIOUSNESS
F. I. Georgiyev and G. F. Khrustov 6 Jan. 1966 16 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 10, 1965 p 14–21
(JPRS-33630; TT-66-30074) CFSTI: $1.00

The functional prerequisites for the development of consciousness are discussed, in relation to the factual material and the hypotheses offered as a result of experimental research. Data are given on several experiments conducted with chimpanzees to determine the development of higher forms of implement activity. It was concluded that this process led to the formation and retention in the psyche of the anthropoid of an object-information complex, or generalized and retained reflection of the basic parameters of the required implement. The difference between the object-information complex and the result of labor is discussed, and the fundamental distinction between the object-information complex and human expediency is delineated. Several theories on the anticipating function of consciousness are also examined, and a qualitative distinction between the intellectual activity of an animal and a man is made.
M.G.J.

N66-15744# Joint Publications Research Service, Washington, D. C.
COMPLEX THERAPY OF ACUTE RADIATION SICKNESS
Ye. Ye. Chebotarev 30 Dec. 1965 101 p Transl. into ENGLISH of selected articles from the book "Kompleksnoye Lecheniye Ostroy Luchevoy Bolezni" Kiev Publishing House "Naukova Dumka", 1965 205 p
(JPRS-33552; TT-65-34126) CFSTI: $3.00

The effect of various therapeutic substances on the course and outcome of radiation sickness was studied, and details are given on the treatment complexes compiled to alleviate the seriousness of radiation injuries and thereby increase the survival rate of the experimental animals. Investigations centered mainly on the therapeutic properties of BK-8 blood substitute, bicillin-3, vitamin B-12, hemopoiesis stimulators such as batyl alcohol, penicillin, streptomycin, ascorbic acid, and vicasol. Results indicate that the most effective complex of therapeutic measures includes substances with a wide range of biological action and which are also less traumatizing to the irradiated organism. A complex consisting of the BK-8 blood substitute, vitamin B-12, batyl alcohol, and bicillin-3 met these requirements; experiments showed that over 50 percent of irradiated

animals survived, and that their regenerative processes developed at an earlier stage. Investigations also showed the expediency of combining the suggested complex therapy with a chemical protection of the organism. M.G.J.

N66-15746# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON MILITARY MEDICINE [LITERATUUROVERZICHT, MILITAIRE GENEESKUNDE]
17 Jul. 1965 41 p In DUTCH and ENGLISH *Its* Vol. II, No. G-122
CFSTI: HC $2.00/MF $0.50

Abstracts on a wide variety of subjects are presented in a literature survey of military medicine. Subjects of the reviews include radiation exposure, dermatology, psychology and psychiatry, aviation medicine, internal medicine, surgery, pharmacology and toxicology, and new trends and devices. M.W.R.

N66-15750# Southwest Research Inst., San Antonio, Tex.
RESEARCH ON ANALYSIS OF AMINO ACIDS BY GAS CHROMATOGRAPHY
D. E. Johnson and T. Goodson Wright-Patterson AFB, Ohio, Sep. 1965 35 p refs
(Contract AF 33(615)-1823)
(AMRL-TR-65-148; AD-624469) CFSTI: HC $3.00/MF $0.50

A gas–liquid chromatographic procedure was developed for the analysis of the essential amino acids for man using the N-trifluoroacetyl methyl ester derivative. The procedure requires 2-1/2 hours for preparation of the sample and gas chromatographic resolution of all the common protein amino acids. The method was applied to the analysis of standard mixtures of amino acids, a protein hydrolyzate of ribonuclease and the free amino acids in human blood plasma. Author (TAB)

N66-15776*# Aeronutronic, Newport Beach, Calif.
EXPERIMENTAL STUDIES FOR THE DETECTION OF PROTEIN IN TRACE AMOUNTS Final Report
E. R. Walwick and B. R. Zalite 28 Jan. 1966 90 p refs
(Contract NASw-770)
(NASA-CR-69551; U-3427) CFSTI: HC $3.00/MF $0.75 CSCL 06A

Further research is presented on a program to demonstrate the utility of the dye, 4,5,4',5'-dibenzo-3,3'-diethyl-9-methylthiacarbocyanine, for the detection of biological macromolecules. Analysis of stoichiometry studies on the reaction of the dye with various macromolecules were carried out and they indicate that for optimal reaction a one to one ratio of dye to anion site on the polymer is generally required to form the various complex states. These states correspond roughly with spectral band maxima at 570, 535, 510, 650 and 470 mμ. Titration of materials giving a J-band (650 mμ peak) indicated that this state arises through reaction of individual dye molecules with particular sites as a function of dye configuration and conformation to the site rather than being due to dye-dye interaction in a very large aggregate of dye molecules as previously supposed. Results from reaction of the dye with soil extracts are presented. Inorganic ions and aluminosilicate minerals which might interfere with the dye reaction were investigated and procedures were developed to circumvent interference. This involved the testing and selection of a soil processing procedure which permitted removal of the inorganic materials from, and retention of the humic acid by, the soil extract. Reaction of the dye with humic acid from soil was investigated by titration of the humic acid with the dye, and determination of functional groups by titration and chemical modification. Author

N66-15782# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
TWO-COMPONENT RADIATION EFFECT ON STRONTIUM^{85} ABSORPTION BY THE RAT ILEUM IN SITU [DE ABSORPTIE VAN STRONTIUM-85 NA BESTRALING DOOR RATTE ILEUM IN SITU]
C. Silber Marcus and O. Vos Oct. 1965 15 p refs
(MBL/1965/26; TDCK-43752) CFSTI: HC $1.00/MF $0.50

Male Wistar rats (150–180 grams) were exposed to 0, 695, 926, and 1158 r whole body X-irradiation and tested for changes in Sr^{85} absorption 1, 2, 3 and 4 days after irradiation by injecting a Sr^{85} solution into ligated ileal sacs *in situ* and recovering the unabsorbed dose 3 hours later. A two-component radiation effect was described. Two days after 695 r, the rats showed a significant decrease in absorption followed by a return to the control level within 2 more days. Three days after 926 r, there was a significant increase in Sr^{85} absorption; those that survived to 4 days showed a trend back to the control level. Three days after 1158 r there was a highly significant increase in absorption; no rats survived beyond 3 days. Y^{91}, which is not at all absorbed by the normal intestine, is also not absorbed by 695 r rats 2 days after irradiation or 1158 r rats 3 days after irradiation. Author

N66-15827*# National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY Bibliography
Jan. 1966 96 p refs
(NASA-SP-7011(19)) CFSTI: HC $1.00/MF $0.75 CSCL 06E

Abstracts on the biological physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space are presented. References describing similar effects on biological organisms of lower order are also included. Related subjects such as sanitary problems, pharmacology, toxicology, safety, survival, life support systems, exobiology, and personnel factors receive appropriate attention. The abstracts were prepared by three contributing organizations, NASA, AIAA, and LC. E.E.B.

N66-15975*# Naval School of Aviation Medicine, Pensacola, Fla. Aerospace Medical Inst.
PRACTICAL AND THEORETICAL IMPLICATIONS BASED ON LONG-TERM FOLLOW-UP OF MENIERE'S PATIENTS TREATED WITH STREPTOMYCIN SULFATE
Ashton Graybiel, Harold F. Schuknecht, Alfred R. Fregly, Earl F. Miller, II, and Michael E. Mc Leod 25 Oct. 1965 30 p refs
Prepared in Cooperation with Mass. Gen. Hospital
(NASA Order R-93)
(NASA-CR-69658; NAMI-948) CFSTI: HC $2.00/MF $0.50 CSCL 06E

Four patients who had received streptomycin sulfate in the treatment of Ménière's disease were evaluated in terms of the long-range effects of therapy and utilized as experimental subjects. The findings are reported in terms of a lack of return of their symptoms, and the effect of the drug on hearing, the semicircular canals, otolith organs, ataxia, and the Coriolis aculogyral illusion. An attempt was made to interpret the findings in terms of the etiology of idiopathic Ménière's disease, and the suggestion is made that it might represent a disturbance attributable to the secretary cells of the crista. Author

N66-15983*# Naval School of Aviation Medicine, Pensacola, Fla.

THE DIAL TEST: A STANDARDIZED PROCEDURE FOR THE EXPERIMENTAL PRODUCTION OF CANAL SICKNESS SYMPTOMATOLOGY IN A ROTATING ENVIRONMENT

Robert S. Kennedy and Ashton Graybiel 10 Jun. 1965 33 p refs (NASA Order R-93)

(NASA-CR-69664; NSAM-930) CFSTI: HC $2.00/MF $0.50 CSCL 06S

Part 1 describes a developmental study to identify an optimum dial test procedure and the results of using the procedure on three groups with differing aviation experience. The problem was to determine that combination of rotational velocity of a slow rotation room, time between dial settings, and number of sequences to be performed which would yield the best measure of susceptibility to motion sickness. Parts 2 and 3 report the correlations between dial test scores and the modified Romberg and the coriolis illusion, and with scores from a motion sickness questionnaire. Modified Romberg scores had a small but significant relationship with dial test scores for the incoming flight student group, and this relationship was almost significant for the proficiency billet aviator group. Coriolis illusion scores were not significantly related to dial test scores but were in the predicted direction. Statistically significant relationships were obtained between dial test score and scores from two keys to the motion sickness questionnaire; these need cross-validation, however. Author

N66-15995# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex. Biodynamics Branch.

MAXIMUM VOLUNTARY VENTILATION AFTER +G_x IMPACT IN HUMANS Interim Report, Feb. 1965

Peter G. Hanson Nov. 1965 18 p refs

(ARL-TR-65-22; AD-624626) CFSTI: HC $1.00/MF $0.50

Eighteen volunteer male subjects were exposed to 20+G_x impact on the Daisy Decelerator. Measurements of maximum voluntary ventilation (MVV) obtained 10 minutes prior to, immediately after, and 20 minutes after impact were compared with previously determined baseline MVV values. The results indicate that MVV performance is elevated immediately after impact. It is suggested that this response is related to subject anxiety with accompanying sympathicotonia. Author (TAB)

N66-16016# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

DIGITAL COMPUTATIONS OF TEMPERATURE IN RETINAL BURN PROBLEMS

J. J. Vos [1963] 24 p refs

(Grant NIH FR-00016-02)

(IZF-1965-16; TDCK-43438) CFSTI: HC $1.00/MF $0.50

A simple method is described to compute intraretinal temperatures during and after irradiation with light. Some data obtained are presented in graphical form. The data are meant to be used as a quantitative basis to analyze and understand results obtained in retinal burn studies. Author

N66-16020*# Stanford Univ., Calif. Instrumentation Research Lab.

FLUORMETRIC ASSAY FOR NUCLEASE ACTIVITY

Vincent L. Stevens 26 Jul. 1965 15 p refs

(Grant NsG-81-60)

(NASA-CR-69662; IRL-1029) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Consideration is given to the preparation of substrates for deoxyribon-nuclease (DNASE) assay, which permits the use of sensitive fluorescent techniques. The proposed procedure is to label the heterocyclic portion of DNA (the preferred substrate of DNASE) with a fluorescent species. As a result of enzyme action low molecular weight fluorescent products are formed. These can be made to pass through a semipermeable membrane and are then readily detected by fluorometry. Because of its high quantum yield of fluorescence, derivatives of fluorescein and related compounds were used as reagents to label DNA; in particular, fluorescein isothiocyanate was used for the preparation of fluorescent protein derivatives. Preliminary experiments with this compound showed that the amino and hydroxyl groups of DNA are hard to label with this reagent and yields were found to be extremely low. Sulfonyl chlorides do, however, react with weakly basic amino groups to form sulfonamides, and relative to this model condensations of napthalene-sulphonyl chloride with adenine were carried out, and yields were shown to be excellent. C.T.C.

N66-16028# Naval School of Aviation Medicine, Pensacola, Fla.

A STUDY OF SOME DETERMINERS OF PSYCHOLOGICAL STRESS

Robert J. Wherry, Jr. and Patrick M. Curran Jul. 1965 43 p refs (NSAM-941; AD-624450) CFSTI: HC $2.00/MF $0.50

The study utilizes a four-choice discrimination task and various levels of electric shock to investigate possible determiners of anticipatory stress, and individual differences in performance decrements resulting from such stress. In general, disruption increases as the threatening event comes closer, as the perceived probability of its occurrence becomes greater, and as the perceived degree of unpleasantness is increased. Whether or not the anticipated unpleasant event really occurred in previous exposures influences behavior in subsequent exposures. There are several indications that anticipatory physical threat stress has a curvilinear relationship to performance, with low amounts of threat enhancing performance. There were wide individual differences in susceptibility to performance disruption by threat. Author (TAB)

N66-16037# Joint Publications Research Service, Washington, D. C.

NOMOGRAMS FOR DETERMINING THE HEIGHT-WEIGHT-CIRCUMFERENCE RELATION IN HUMAN SUBJECTS

D. A. Zhdanov 11 Jan. 1966 19 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. i Embriol. (Leningrad), no. 10, Oct. 1965 p 33-42

(JPRS-33694; TT-66-30138) CFSTI: $1.00

The dimensions of body weight, standing weight, chest circumference, and the distance from the suprasternal point to the pubic point were measured in over two thousand male and female subjects for the purpose of preparing nomograms for determining body weight on the basis of body length and chest circumference. The nomograms are shown. The subjects were either manual or office workers, and ranged in age from 21 to 65. The data were processed by the variational-statistical method, and the form of equations used for computing the statistical parameters is specified. The results of the measurements were grouped on the basis of 5-year age categories, and the number of observations for each age interval was not less than 100. Observations on the relationship of body weight changes with age to the occurrence of health problems (such as heart damage) are noted; and recommendations on the use of the nomographs and accompanying tables by a general physician are made. Several case history examples are discussed. L.S.

N66-16046*# Beckman Instruments, Inc., Fullerton, Calif. Space Engineering Dept.

STUDY PROGRAM FOR BIOCHEMICAL MONITORING BY PAROTID SECRETION Final Report

[1964] 101 p refs

(Contract NAS2-2594)

(NASA-CR-69691) CFSTI: HC $4.00/MF $0.75 CSCL 06A

An investigation was conducted on monitoring biochemical changes in body fluids under varying conditions by parotid secretion. More than two thousand analyses were made on body fluid samples from 102 subjects of three distinct groups: normal, or general population; hospitalized patients; and a select group of marine pilots. The homogenous third group was subjected to a series of body function tests, with sampling of this group for the various chemical components done during exercise and post-exercise periods. It was found that simple body function tests rapidly elicited distinct changes in concentration of parotid components greatly in excess of those evidenced in other monitored body fluids. The potential use of parotid secretion as an indicator of physiological changes is clearly documented. A statistical comparison of mean concentrations of several components in parotid showed the marine control group to be separate from the normal and hospitalized populations. C.T.C.

N66-16106*# Naval School of Aviation Medicine, Pensacola, Fla.

THE ROLE OF THE VESTIBULAR ORGANS IN THE EXPLORATION OF SPACE

Washington, NASA, 1965 376 p refs Symp. held in Pensacola, Fla., 20–22 Jan. 1965 Sponsored by NASA

(NASA-SP-77) GPO: HC $2.25; CFSTI: MF $2.00 CSCL 06S

Symposium papers on the role of the vestibular organs, the semicircular canals, and otolith apparatus in space exploration are presented. For individual titles see N66-16107–N66-16137.

N66-16107* Zurich Univ. (Switzerland).

ULTRASTRUCTURAL STUDIES OF THE LABYRINTH IN SQUIRREL MONKEYS

Heinrich H. Spoendlin *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 7–22 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

The relationship of the vestibular sensory epithelia to the functional behavior of sensory receptors is investigated in squirrel monkeys. Direction specificity and asymmetric mode of action of the receptors is considered, and the polarization of the vestibular sensory hairs of the entire surface of the cristae and maculae in certain mammals is studied via phase contact microscopy. The reversed function pattern of horizontal and vertical cristae is related to a reversed morphological polarization of the sensory hairs. A direct relation between the arrangement of the kinocilia and sensory cell functions indicates the kinocilium to be an important structure for sensory cell stimulation. In the maculae the sensory hairs, although shorter, have the same structure; and the kinocilia are also uniformly polarized over wide areas. The enormous variety and large number of synaptic structures in the vestibular sensory epithelia of the squirrel monkey might be related to the functional importance of the gravity receptors for these animals for whom acrobatic skill is so important for survival. In some sensory cells, however, no synaptic structures are found, suggesting these structures are not of a permanent nature. M.W.R.

N66-16108* Naval School of Aviation Medicine, Pensacola, Fla.

FORM AND INNERVATION OF THE VESTIBULAR EPITHELIA

Harlow W. Ades and Hans Engström (Göteborg Univ.) *In its* The Role of the Vestibular Organs in the Exploration of Space 1965 p 23–41 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

The present study has shown that the vestibular sensory cells are of two basic types; however, cells are also found which are intermediate in form. These presumably represent stages of partial differentiation from the more primitive type II cell toward the type I. It has been clearly established that sensory cells of both types may be innervated by the same nerve fiber. It is apparent also that the pattern of innervation of vestibular sensory cells is much more complicated than has been believed hitherto. Finally, this study has shown that well defined "synaptic regions" can be found between the nerve calyx and the base of the type I sensory cell, and that these are very much like the supposed synaptic regions which are seen between the sparsely granulated type of nerve ending and the type II Sensory cells. Author

N66-16109* Naval School of Aviation Medicine, Pensacola, Fla.

AN EXPERIMENTAL APPROACH TO THE DYNAMICS OF THE VESTIBULAR MECHANISMS

Jorma I. Niven, W. Carroll Hixson, and Manning J. Correia *In its* The Role of the Vestibular Organs in the Exploration of Space 1965 p 43–56 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Prediction of vestibular response to nonphysiological static and dynamic acceleration stimuli of the space environment is based on the use of sinusoidal angular stimulus of variable frequency and magnitude and expressing the nystagmus transition response in electrical degrees. A mathematical formulation is given for the basic stimulus–response relationship between steady-state nystagmic eye velocity and periodic angular accelerations. Investigations are made of the performance characteristics of the semicircular canals in their transduction of angular accelerations, as well as linear accelerations and otolith organs. It is found that a strong highly systematic stimulus-bound horizontal nystagmus is produced by the periodic linear acceleration stimuli whether the subject's head is lightly constrained or rigidly fixed during linear oscillations. The precise responding mechanisms, whether otoliths or canals, cannot be identified. M.W.R.

N66-16110* Goodyear Aerospace Corp., Litchfield Park, Ariz.

THE "MATCH" OF THE SEMICIRCULAR CANALS TO THE DYNAMIC REQUIREMENTS OF VARIOUS SPECIES

Robert Mayne *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 57–67 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Concepts of frequency response and elementary information theory are used to match the semicircular canals to dynamic requirements of various species. It is suggested that five adjustable parameters be considered: the internal diameter of the canal, radius of its curvature, volume of the ampulla, stiffness of the cupula, and possibly the number of sensory cells in the cristae. The behavior of the semicircular canals is considered in terms of the upper and lower ranges of tha frequency band and the resolution possessed by physiological sensors. It is pointed out that the large canals of

fish, as compared to mammals is one of the best illustrations of the match of these sensors to biological systems and efficient design and economy in configurations of nature. M.W.R.

N66-16111* National Aeromedical Center, Soesterberg (Netherlands).

THE MODULATING INFLUENCE OF THE OTOLITH ORGANS ON SEMICIRCULAR CANAL FUNCTIONS

Martin P. Lansberg *In* NSAM The role of the Vestibular Organs in the Exploration of Space 1965 p 69–75 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Experiments on a slow rotation platform reveal that magnitude and direction of nystagmus varies with the subject's heading in cases where orientation of the canal system relative to the plane of rotation remains unchanged. When the subject is heading forward, nystagmus is strong and a long duration; when heading backward, nystagmus does not reach the anticipated magnitude, lasts for a shorter period than expected, and gradually changes plane and direction. This implies that the otoliths can modulate an ampullar signal and perhaps have both a nystagmuss modifying and generating power. M.W.R.

N66-16112* State Univ. of Iowa, Iowa City. College of Medicine.

INFLUENCE OF THE OTOLITHS ON THE DURATION OF POST-CALORIC NYSTAGMUS

Bosko Milojevic *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 77–84 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

The otolith system of 22 adult cats, with normal response on caloric stimulation, was stimulated on the fronto–occipital axis at 45 and 135° angles. Since nystagmus duration increases when the otoliths provoke stronger stimuli on the otolith membrane, it is suggested that the otolith system has a controlling regulatory mechanism over post-caloric duration of nystagmus through central parkways. A table and graphs summarize nystagmus duration and maximum slow and fast phase velocities for both ears in 11 cats. M.W.R.

N66-16113* Army Medical Research Lab., Fort Knox, Ky.

RESPONSE OF SINGLE CELLS IN CAT BRAIN STEM TO ANGULAR ACCELERATION IN THE HORIZONTAL PLANE

George H. Crampton *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 85–96 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Single units within the brain stem of deeply anesthetized cats were observed for long periods during which the animal was repeatedly subjected to long duration angular accelerations. The head was centered over the vertical axis of rotation and the horizontal stereotaxic plane of the head was parallel to the plane of rotation. Observations were made of adaptation, habituation, and forms of response discharge. Electrode tip locations were confirmed histologically. No regular evidence for a reduction in discharge rate could be found (1) during the application of a long angular acceleration or (2) from acceleration to acceleration. There are indications of changes in patterning of the discharge with repeated stimulation which may reflect habituation. A new form of response is described which appears to act as a binary switch, in that it holds a discharge rate for long periods after a stimulation, and is turned on and off by alternating negative and positive angular accelerations. Author

N66-16114* Naval School of Aviation Medicine, Pensacola, Fla.

A NEW QUANTITATIVE ATAXIA TEST BATTERY

Ashton Graybiel and Alfred R. Fregly *In its* The Role of the Vestibular Organs in the Exploration of Space 1965 p 99–119 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

A new multidimensional quantitative ataxia test battery employing the "rail method" of testing was developed to assess more precisely than heretofore postural equilibrium–disequilibrium under unusual conditions and stresses such as rotating environments. High reliability, including test-retest reliability, was demonstrated for each of two versions: a long version employing six rails of varying widths, and a short version employing two of these rails. Normative standards covering a wide age range; and age, height, and weight influences upon performance; tentative sex differences in performance, practice effects; and test battery relationships with several clinical-type ataxia tests were determined. Validity of the standardized test procedures in the laboratory, in the field and in clinical situations was demonstrated, present and future uses of the test battery in normals and auricular-involved individuals in vestibular research as well as in related research-clinical areas were outlined, and several methodological limitations were indicated. Author

N66-16115* Naval School of Aviation Medicine, Pensacola, Fla.

OTOLITH FUNCTION AS MEASURED BY OCULAR COUNTERROLLING

Earl F. Miller, II and Ashton Graybiel *In its* The Role of the Vestibular Organs in the Exploration of Space 1965 p 121–131 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

This report summarizes the results of several studies in which the effect upon otolith activity of change in magnitude or direction of the gravitoinertial force was determined in man by measuring the particular vestibulo-ocular reflex of counterrolling. In these studies hypergravic forces were generated by means of centrifugation while periods of partial or complete weightlessness were produced by ballistic flights in specially equipped aircraft. Since the available periods of reduced gravity were relatively short, the rapid adjustment in counterrolling position in response to the acting gravitational stimulus made this index of otolith activity particularly well-suited for study. A photographic method developed for quantitatively studying counterrolling movement in normal and labyrinthine-defective subjects provided the accuracy required for measuring the extremely small response changes found under reduced G loading. The average data of several normal subjects indicated that the relationship between otolith activity and gravitational force expressed in $\log_{10}$ units was linear, i.e., obeyed Fechner's law, from approximately 0.6 G up to at least 1.0 G and probably beyond. Below 0.6 G the otolithic response began to deviate from linearity and asymptotically approached its zero level at some infinitely small G value. The possible application of these findings to manned space flights was outlined. Author

N66-16116* Rochester Univ., N. Y. Dept. of Psychology.

THE NATURE OF ADAPTATION TO OSCILLATORY ROTATION

G. Richard Wendt *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 133–139 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Experimental evidence is offered for a theory, proposed to explain habituation to rotation, which says that nystagmus

was lost because it was replaced by a competing wandering-type eye movement system. Both electric and photographic recordings of eye movements are used; and the stimulation device is a horizontally rotating platform with the subjects seated at the center of rotation. Use of sinusoidal oscillation through 20° of the arc at 18 cycles/minute keeps the labyrinths under continuous stimulation to permit a continuous record of adaptation. The alternation of rotation direction shows that the habituation process results in compensatory opposite reaction. During habituation the fast phases increase in frequency; the onset and cessation of each fast phase is exactly synchronous in both eyes, and eventually becomes a wandering movement. It is speculated that as the subject is repeatedly exposed to the same pattern of oscillation or turning, a kind of learning takes place. During periods when no vestibular or visual stimuli are present in the relaxed subject, the eyes wander irregularly and no longer have a fixed position. M.W.R.

N66-16117* Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Research Inst.

REPEATED CALORIC STIMULATION OF THE HUMAN LABYRINTH AND THE QUESTION OF VESTIBULAR HABITUATION

William E. Collins *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 141–150 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Forty unilateral caloric irrigations were administered in a habituation series to each of two groups of subjects. One group was tested in total darkness. The second group was stimulated in illumination and actively attempted to control and suppress their eye movements by means of visual fixation. Pre- and post-tests were administered (always in total darkness) in which both directions of response were elicited. In all cases, tasks were assigned to subjects to maintain alertness. The nystagmic reaction was altered as a result of the habituation series, but the change was different for the two groups. After one month of rest, there was no apparent recovery of the response toward the pretest level for either group. Subjective reactions declined in intensity for the two groups, but showed recovery after a 1-month rest period. Author

N66-16118* San Jose State Coll. Foundation, Calif.

SOME FACTORS CONTRIBUTING TO THE DELAY IN THE PERCEPTION OF THE OCULOGRAVIC ILLUSION

Brant Clark and Ashton Graybiel (NSAM) *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 151–162 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

The purpose of the five experiments reported here was to study some variables which influence the lag in the perception of the oculogravic illusion following a change in the direction and magnitude of resultant force acting on the subject. All the observations were made with the subject facing the direction of rotation while he observed a collimated, luminous line. Five normal and nine labyrinthine defective men acted as subjects. The subjects' task was to set the luminous line to the apparent horizontal following different conditions of pre-exposure to a visual framwork, of different exposure to the luminous line, and for different periods of constant rotation of the room. The inertial-lag effect was found to occur in both normals and labyrinthine defective subjects, but the oculogravic illusion was significantly greater in the normal subjects for short periods of observation. Change in the perception of the horizontal continued systematically for the labyrinthine defective subjects for about 1 hour, at the end of each time the magnitude of the oculogravic illusion was not significantly different for the two groups. Pre-exposure to a visual field was found to be of little importance in producing the lag effect, but setting the line to horizontal during rotation does reduce the lag effect. The results are discussed in terms of Adaptation Level Theory. Author

N66-16119* McGill Univ., Montreal (Quebec). Aviation Medical Research.

THE VESTIBULAR CONTRIBUTION TO STABILIZATION OF THE RETINAL IMAGE

G. Melvill Jones *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 163–172 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

The vestibulo-ocular reflex system is examined in the context of an essential backup to the visual fixation reflex. The vestibular stimulus is seen as the output from an angular velocity transducing hydrodynamic system, feeding the central nervous system with angular velocity modulated information, provided the mechanical stimulus is confined within a specified frequency range. This general interpretation appears to apply over a wide range of different animal species. The central nervous angular velocity signal is envisaged as driving an angular velocity control system through the physiology of the oculo-motor system. It appears that the dynamic response of the vestibulo-ocular system improves as that of the visual tracking system fails, to the extent that the former operates with a gain of 1 at frequencies associated with failure of the latter. The overall system is apparently superimposed by a pattern of response which insures that compensating eye muscles are stretched on an average by an amount directly related to the compensatory eye angular velocity required for image stabilization at every instant. In addition, the system response is substantially dependent upon the axis of rotation referred to the head, in the sense that the rate of intrusion of errors attributable to cupular restoration is greater in the vertical than in the horizontal planes. Moreover, in the roll plane there appears to be relatively poor visual tracking, and this permits the virtually unopposed operation of the vestibulo-ocular reflex when the latter is at variance with the real event. Author

N66-16120* California Univ., Berkeley. Donner Lab.

RADIOSENSITIVITY OF THE VESTIBULAR APPARATUS OF THE RABBIT

Larry W. Mc Donald, Gerald A. King, and Cornelius A. Tobias *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 175–182 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

A method of radiating the inner ear of the rabbit with an alpha particle beam without significant exposure of the brain has been devised. Long lasting changes in semicircular canal function of the rabbit have been demonstrated with doses of 500 rads. The approaches to determine the threshold of radiosensitivity of the semicircular canal function and the radiosensitivity of the macula utriculi are described. Structural changes are discussed which may account for the functional alterations observed. Work being undertaken to study the structural changes is described. Author

N66-16121* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

PRELIMINARY STUDIES OF VESTIBULAR DAMAGE IN GUINEA PIGS FOLLOWING HIGH ACCELERATION

Donald E. Parker, Henning E. von Gierke, and Walter P. Covell (Washington Univ., St. Louis, Mo.) *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 183–194 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Guinea pigs were exposed to high impact deceleration on a sled and short-duration acceleration on a centrifuge. Behavioral examination of swimming ability and the righting reflex revealed evidence of vestibular damage following exposure to peak acceleration in the range of 200 to 400 g for periods of 14–20 sec. Histological examination of the temporal bones demonstrated extensive structural damage for the same animals which exhibited behavioral deficiency. No evidence of behavioral damage has been observed following exposure to impact deceleration. Also, histological evidence of damage is considerably less following impact deceleration than short-duration centrifugation. Author

N66-16122* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
DYNAMIC COUNTERROLLING OF THE EYE IN NORMAL SUBJECTS AND IN PERSONS WITH BILATERAL LABYRINTHINE DEFECTS
Robert S. Kellogg *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 195–202 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Measurements were made on both normal and bilaterally labyrinthine defective (L-D) subjects, at rotation rates from static to 15 rpm in both clockwise and counterclockwise directions. A modified F-104 ejection seat was bolted to the rear axle and differential assembly of a 2.5 ton truck; the seat was equipped with lap belt, shoulder harness, and various straps. A bite bar is held securely in the subject's mouth. Counterrolling responses were not exhibited by L-D subjects in either the static or dynamic condition. Amplitude of the curves is found to be inversely related to the rotation rates, and may be explained in terms of zero G tumbling effect which would tend toward less stimulation of the otolith as rotation increases. There is a lag time in otolith response. M.W.R.

N66-16123* Baylor Univ., Houston, Tex. Coll. of Medicine.
CLINICAL PROBLEMS ASSOCIATED WITH PROLONGED EXPOSURE TO WEIGHTLESSNESS
William S. Fields *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 203–207 (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

It is emphasized that weightlessness alone does not necessarily produce any disorientation or clinical disorder of vestibular function following exposure for a period of 24 hours; no information is available regarding effects of prolonged periods of weightlessness of more than two weeks. Vestibular sickness after a space flight may be somewhat analogous to the post-rotation effects observed in subjects who come out of the slow rotation room. Both severity of stress and length of exposure are important factors. Vestibular disorders are considered unlikely during prolonged space flight but possible problems in a manned space station. High intensity sound levels may damage the cochlea and produce serious effects on the vestibular apparatus. At the moment, it is not possible to predict the scope of such problems that will be encountered in space. It is emphasized that the equilibrium disorder suffered by John Glenn following his fall is in no way related to his participation in the Mercury Program. M.W.R.

N66-16125* Defence Research Medical Labs., Toronto (Ontario).
SOME VESTIBULAR RESPONSES PERTAINING TO SPACE TRAVEL
Walter H. Johnson, Kenneth E. Money, and Ashton Graybiel (NSAM) *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 215–219 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Experiments are described which attempt to determine the importance of the labyrinth in spatial orientation during parabolic flights. Studies with both monkeys and humans confirm that weightlessness alone is unlikely to cause motion sickness. Evidence indicates that semicircular canal stimulation is of prime importance in causing motion sickness. When the canals of squirrel monkeys are inactivated, no signs of motion sickness are exhibited. Although normal otolith function is retained, normally functioning labyrinths should be of value in providing spatial orientation to the space traveler. M.W.R.

N66-16126* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
SPONTANEOUS FIRING AND RESPONSES TO LINEAR ACCELERATION OF SINGLE OTOLITH UNITS OF THE FROG DURING SHORT PERIODS OF WEIGHTLESSNESS DURING PARABOLIC FLIGHT
Torquato Gualtierotti and Siegfried J. Gerathewohl (NASA, Washington) *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 221–229 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Quantitative information on the effect of zero gravity on the vestibular responses is obtained by comparison of records from a single vestibular unit yielding spontaneous and evoked activity on weightlessness and at one G. A tungsten micro-electrode provides recordings from the same nerve fiber over a long period of time and under anticipated flight conditions. To select the desired fiber in the vestibular nerve, a frog is tested on a tilt table and then completely immersed in an aluminum container. During the flight, the frog is placed so that the otolith unit can respond to acceleration in the direction of the stimulus. During parabolic flight, main changes observed in the single otolith unit activity are: (1) a sudden increase of spontaneous firing at the beginning of weightlessness preceded by a high G period; (2) an initial larger response to acceleration; (3) a sudden suppression of response, restored to normal by returning to one G; and (4) a large increase in overall spontaneous activity of the nerve after a number of short-interval parabolas. It is doubtful if these changes are due solely to weightlessness. Further, parabolic flight does not give complete information on the effect of weightlessness on the vestibular organ. M.W.R.

N66-16128* Naval School of Aviation Medicine, Pensacola, Fla.
COMPARISON OF VESTIBULAR EFFECTS IN SEVERAL ROTATING ENVIRONMENTS
Fred E. Guedry, Jr. *In its* The Role of the Vestibular Organs in the Exploration of Space 1965 p 243–255 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

It is necessary to consider the basic differences in vestibular stimulation in different rotating environments in order to anticipate conditions in a rotating space environment. Since the particular pattern of canal stimulation is controlled by the position of the head relative to the plane of rotation, a comparison is made of all subjects in four different head positions for which the direction and magnitude of gravity in the rotating room changes with the plane of rotation. Results indicate that when a man is oriented gradually as he will be in a space station, the same head movement relative to the body may result in a variety of reactions, which are dependent on orientation in terms of the rotation direction of the vehicle. Some studies indicate that actual space conditions will present more drastic results and that adaptation to the space station may be somewhat different than that in a rotating room. It is noted, however, that there are indications that habituation to

complex vestibular stimulation in one kind of rotation environment may have a carry-over in reducing undesirable effects in another rotation environment. Results are presented for nystagmus responses to head movements after various periods before and after rotation; and predicted and obtained nystagmus for 12 subjects are illustrated for various head positions. M.W.R.

N66-16129* Defence Research Medical Labs., Toronto (Ontario).

VESTIBULAR PROBLEMS IN ROTATING SPACECRAFT

Kenneth E. Money *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 257–262 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

From the point of view of vestibular physiology, particularly motion sickness, zero gravity is acceptable for long-term space flights, whereas rotation rates of 3 to 5 rpm create hazardous conditions. Motion sickness has been reported in experiments in rotating rooms at these rates, which are probably less variable and of less intensity than can be expected in a rotating spacecraft. To prevent vestibular problems during spacecraft flight, the rotation speed of the spacecraft must be maintained at a low enough level, probably in the order of 1 rpm. At the present time, however, it is impossible to estimate with any accuracy the likelihood of an astronaut becoming motion sick in a spacecraft rotating at 4 rpm; and at the current level of knowledge it is considered unwise to place men who must move into a rotating spacecraft. Before rotation of a spacecraft is adopted in order to solve the cardiovascular problems of weightlessness, it should be shown that such problems at zero g are a greater danger to the mission than the vestibular problems created by rotation. M.W.R.

N66-16132* Naval School of Aviation Medicine, Pensacola, Fla.

THE EFFECTS OF EXPOSURE TO A ROTATING ENVIRONMENT (10 rpm) ON FOUR AVIATORS FOR A PERIOD OF 12 DAYS

Ashton Graybiel, Robert S. Kennedy, Fred E. Guedry, Jr., Michael E. Mc Leod, Edward C. Knoblock (WRAIR, Washington) et al *In its* The Role of the Vestibular Organs in the Exploration of Space 1965 p 295–337 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Countermeasures in addition to adaptation are shown to be necessary if rotational velocities of 10 rpm are required by spacecraft. Rotating room experiments show that when the subject is asleep or his head is fixed, conditions are not too different than those with the room stationary. Movements of the head out of the horizontal plane of the rotating room cause semicircular canal disturbance; whole body movements, which generate Coriolis forces, affect neuromuscular coordination. Two distinct prerotation periods are found. At first subjects restrict head movements and physical activity to prevent nausea; when nausea symptoms disappear, restrictions on head movements are lifted, which in turn increase the stimulus to the semicircular canals. This latter period is characterized by a rising level of physical activity. The first of 12 days rotation made the greatest overall impact on the four aviators who were exposed to the 10 rpm environment. All of the subjects concluded that they were, at one time or another during the exposure period, unfit to carry out the tasks required for an orbital flight; and objective results confirmed this conclusion. M.W.R.

N66-16134* Walter Reed Army Inst. of Research, Washington, D.C.

BIOCHEMICAL RESPONSES TO VESTIBULAR STIMULATION

Edward C. Knoblock *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 347–355 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

A series of biochemical parameters was measured in an attempt to focus critical areas of biochemical responses to motion sickness attending prolonged exposure to a moving room environment. The most striking finding in the study is the demonstration of an increased glucose utilization by normal subjects in comparison with labyrinth-defective volunteers. These findings are consistent with a hypothesis drawn from a previous study (pilots, 1962) that changes in glucose tolerance may be caused by increased muscle tonus in normal subjects. The increase in tonus may be a direct result of labyrinth stimulation. This hypothesis is supported by determination of pH which showed a decrease, by an increased pCO_2, and by a steady or slightly decreased pO_2 value for normal subjects. The LDH value was also increased in the pilot group only. These are the types of responses that would be expected. The L-D groups should not show such a response. With a possible exception to an unexplained response in pO_2 in the pilot 1964 group, this hypothesis is borne out. Author

N66-16135* Naval School of Aviation Medicine, Pensacola, Fla.

STRESS MEASUREMENTS IN NORMAL AND LABYRINTHINE DEFECTIVE SUBJECTS IN UNUSUAL FORCE ENVIRONMENTS

James K. Colehour *In its* The Role of the Vestibular Organs in the Exploration of Space 1965 p 357–371 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Stress hormone excretion rates were measured in both normal and labyrinthine defective subjects exposed to unusual and different force backgrounds in a series of three different experiments. The effects of the systemic and neurogenic stress were measured as increased levels of 17-hydroxy corticosteroids and catechol amine in urine excretion. Uropepsin assays and leukocyte counts of blood samples were also made. In the first experiment, both subject groups were exposed to an intensive set of acrobatic flight maneuvers lasting about 30 mins in which four G pullout maneuvers (a very stressful incident for the uninitiated subjects) were made. In the second experiment, the subjects were subjected to Coriolis acceleration during zero gravity flight; and in the third experiment eight subjects from each group were tested in a relatively small ship at sea in which the pitch and roll of the ship was the motion variant. The data for the experiments are tabulated, and are also depicted by bar graphs. L.S.

N66-16136* Arkansas Univ., Little Rock. Medical School.

ANTIMOTION SICKNESS DRUGS FOR AEROSPACE

Charles D. Wood *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 365–371 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Anti-motion-sickness drugs were orally administered to naval personnel subjects for studying the relative effectiveness and side effects of the drugs. A total of 112 separate experiments were performed on the subjects using eight different drugs. The drugs and the doses used are tabulated. The subjects were given questionnaires to record the side effects produced by the drugs, and medical surveillance was maintained for 8 hrs following administration of the drugs. Blood pressures and pulse rates were recorded periodically. Head movement studies of the subjects in slow rotation rooms were conducted, as a method of comparing the drugs. The effectiveness of each of the drugs is graphically portrayed in terms of tolerated head movements in experimental and control groups. The anti-motion-sickness study was repeated a

second time, using increased dosages of the same drugs. The therapeutic effect was enhanced by the increased dose with only two of the drug preparations used, d-amphetamine (20 mg) and a combination of d-amphetamine (20 mg) and hyoscine (1.2 mg). The results of the questionnaire on side effects are tabulated, and a discussion of the significance of the various test results is given. L.S.

N66-16137* Naval School of Aviation Medicine, Pensacola, Fla.

TEMPORARY SUPPRESSION OF SEMICIRCULAR CANAL FUNCTION IN SQUIRREL MONKEYS AFTER STREPTOMYCIN SULFATE

Makoto Igarashi *In its* The Role of the Vestibular Organs in the Exploration of Space 1965 p 373–384 refs (See N66-16106 06-04) GPO: HC $2.25 CFSTI: MF $2.00

Streptomycin sulfate was administrered to eight squirrel monkeys by injection over a period of three weeks for studying the compound's effect on the temporary suppression of the semicircular canal function of the ear, without damaging the hearing end organs. The total dosage for each monkey was different, increasing from 1100 mgr to 4600 mgr. The suppression was repeatedly measured by the threshold caloric test and susceptibility to vomiting in a slow rotation room. Six months after the suppression, pathological studies were carried out. All animals were sacrificed, and bone samples of the ear were examined by light microscopy. All functional test results and the pathological findings of both vestibule and cochlea are summarized in a table. Results indicate that neither a normal caloric threshold nor susceptibility to vomiting in a slow rotation room is a reliable indicator of morphological normality of the canal criteria. Other significant conclusions from the findings are summarized. Generally, it was shown that the administration of streptomycin sulfate is a useful method of selectively suppressing the semicircular canal function. L.S.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N66-15226*# Israel Program for Scientific Translations, Ltd., Jerusalem.

FUNDAMENTALS OF ENGINEERING CYBERNETICS

E. A. Yakubaitis 1965 263 p refs Transl. into ENGLISH of the book "Osnovy Tekhnicheskoi Kibernetiki" Riga, Izd., Akad. Nauk Latv. SSR, 1962 p 1–242 Publ. for NASA and NSF (NASA-TT-F-290; TT-65-50116) CFSTI: HC $6.00/MF $2.00 CSCL 06D

Trends in engineering cybernetics and theoretical problems in automatic control systems are considered in a textbook intended for college students as well as for engineers concerned with automation in industry, transport, and agriculture. Chapters are devoted to types of signals and their conversion, electronic logical elements, statistical methods for the analysis of automatic control systems, and adaptive control systems. There is an introduction to the theory of probability and consideration of elements of information theory. Principles of the theory of nonlinear automatic control systems are also discussed. Learning and the imitation of the learning process are related to automatic control systems. M.W.R.

N66-15334# Human Engineering Labs., Aberdeen Proving Ground, Md.

CHECK-READING ACCURACY AS A FUNCTION OF DIAL ALIGNMENT IN AN EXTENDED-POINTER DIAL DISPLAY

Lynn C. Oatman Feb. 1965 19 p refs

(TM-2-65; AD-616881) CFSTI: HC $1.00/MF $0.50

Two simulated dial displays were compared in a check-reading task. The pointers were aligned at 12 o'clock in one display and at 9 o'clock in the other. The dial displays were presented to 39 subjects who were asked to indicate whether the display contained a deviant pointer and, if so, to locate it. The data indicate that subjects performed about equally well with the two pointer alignments. Locations of the deviant dials within the displays were an important determinant of the number of deviant pointers detected. Author (TAB)

N66-15349*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.

WASTE MANAGEMENT AND PERSONAL HYGIENE FOR EXTENDED SPACECRAFT MISSIONS

Norman Belasco and Donald M. Perry [1964] 43 p refs Presented at the Am. Ind. Hyg. Conf., Philadelphia, 26–30 Apr. 1964

(NASA-TM-X-57096) CFSTI: HC $2.00/MF $0.50 CSCL 06K

Spacecraft missions of extended time duration require waste management and personal hygiene facilities that will be reliable, sanitary, psychologically acceptable, have man–vehicle–system compatibility, and have use procedures duplicating earthbound modes. This paper contains a discussion of the specific nature of the major problems relative to waste management and personal hygiene on long term multiman missions. Equipment requirements, design concepts, and status of equipment development are discussed sequentially. More specifically, for waste management, the major considerations of collection, transport, storage, treatment, and rejection of excreta are reviewed. For personal hygiene, shaving, showering, superficial body cleansing, oral hygiene, and cleaning of clothes and equipment are considered. Author

N66-15472# Defence Research Medical Labs., Toronto (Ontario).

A TABLE OF d' FOR A MODEL OF THE UNFORCED CHOICE EXPERIMENT

M. M. Taylor and W. C. G. Fraser Jun. 1965 32 p refs

(DRML-534) CFSTI: HC $2.00/MF $0.50

A table of d' is presented for a model of an intermediate condition, in which the observer must decide if a signal was actually presented in one of two intervals. Three responses are available: interval 1, interval 2, and no decision. Two different models of observer behavior appropriate to the unforced choice experiment are described, and the derivation of the likelihood ratio distributions in each detection theory is summarized. The values of d' are given for the unbiased model in terms of the proportions of all correct and wrong responses to intervals in which a signal is presented. Only positive decisions that the signal was in the first or second interval are counted as correct or wrong. No decision responses are included in the total from which the proportions are derived, but are not counted as either correct or wrong. The numerical computations and the use of the table are described. Also included are a 7090 Fortran program for computing d' and criterion levels for arbitrary values of P (wrong) and P (no decision), and for arbitrary values of the standard deviations in the two dimensions; and a subroutine for computing a table of d' with constant values of the standard deviations and arbitrary constant steps in probability. M.G.J.

N66-15509# BioTechnology, Inc., Arlington, Va.
THE TRANSLATION OF VISUAL INFORMATION INTO VEHICULAR CONTROL ACTIONS
Raymond E. Reilly, Robert R. Gilbert, Richard F. Dillon, and James F. Parker, Jr. Oct. 1965 64 p refs Sponsored by Va. Dept. of Highways
(BTI-65-2)

The use of visual information from a land vehicle tail-light system is studied in relation to specific vehicular control actions by the driver. Particular attention is given to the angular velocity cue provided by the increase in vehicle visual angle provided by the two tail lights as the driver approaches the rear of a vehicle. It appears that a driver uses both the angular velocity cue as well as the speed of his own vehicle in making the decision to stop. Other cues appear to give important perceptual information, although individuals operate within the entirety of the visual environment rather than from separate cues. It is concluded that all the visual information available to a driver is used in a highly systematic manner to effect control actions. Specific characteristics of tail-light systems were found to have a significant effect on braking behavior, and a system with large, bright lights separated by 60 inches consistently produces better braking responses from drivers. M.W.R.

N66-15668# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
TYPE K GASMASK FOR USE WITH GLASSES [INZETMONTUUR VOOR GASMASKER K]
E. W. Lindeijer 6 Sept. 1965 20 p In DUTCH
(TL/1965/18; TDCK-43436) CFSTI: HC $1.00/MF $0.50

Details are given on a glass frame attachment for use with the type K gas mask. The device was developed to facilitate the use of gas masks by persons who wear glasses, and to prevent steaming of the glasses while wearing the mask. The optical requirements are outlined, and the structural changes involving the ring attachment, the rim, and the closures are described. Schematics show the design. Among the advantages cited are the ease with which the frames can be put on, and the elimination of the steaming problem through use of a specially treated ultra-clear material. Transl. by J.O.

N66-15718# MSA Research Corp., Callery, Pa.
POTASSIUM SUPEROXIDE ATMOSPHERE CONTROL UNIT Final Report, Mar.–Dec. 1964
M. J. Mc Goff Wright-Patterson AFB, Ohio, AMRL Sep. 1965 54 p
(Contract AF 33(615)-1518)
(MSAR-64-123; AMRL-TR-65-44; AD-624556) CFSTI: HC $3.00/MF $0.50

Superoxides were used in a new approach to atmosphere control systems for aerospace flight. This approach offers the control of dynamic systems and the low power requirement of passive systems. This technique can be adapted to unusual geometries with low weight and volume requirements. Potassium superoxide discs comprise the bulk of this new unit serving as a structural self-support and yet offering adequate carbon dioxide absorption and oxygen evolution. The discs are 3.77 in. in diameter × 3/16 in. thick and have a 7/8 in. diameter center hole. They are placed in a cylindrical aluminum housing with a 0.080 in. clearance between the shell and discs. The discs are separated from each other by integrally molded 1/16 in. protrusions. A one-man version of the unit for 24 hour service weighs 12 pounds, requires 17 watts power continuously, is 32 in. long × 4 in. in diameter and contains 110 discs. The disc configuration permits both radial and axial circulation at a throughput of 9 CFM and 1.6 in. of water. Tests with a one-man simulator in a 130 cu ft compartment showed adequate oxygen delivery and control at less than 1% carbon dioxide. Author (TAB)

N66-15752# Naval Training Device Center, Port Washington, N. Y. Communications Div.
DETECTION IN A HOMOGENEOUS VISUAL FIELD UNDER A CONDITION OF INFINITE DEPTH
John F. Catalano and Milton S. Katz 19 Aug. 1965 15 p refs
(NAVTRADEVCEN-1H-33; AD-624531) CFSTI: HC $1.00/MF $0.50

It has been proposed by Whiteside that in a homogeneous visual environment involuntary accommodation results in a myopic condition which impairs target detection. A means of overcoming this myopia by approximating a condition of infinite depth of focus with the use of an artificial pupil was studied. No improvement of target detection resulted from this procedure. Author (TAB)

N66-15760* System Research, Ltd., Richmond (England).
A STUDY OF GROUP DECISION MAKING AND COMMUNICATION PATTERNS UNDER CONDITIONS OF STRESS AND OVERLOAD, WHEN THE PARTICIPANTS ARE PERMITTED TO FUNCTION AS A SELF-ORGANISING SYSTEM Quarterly Technical Status Report, 1 Apr.–30 Jun. 1965
[1965] 5 p
(Contract DA-91-591-EUC-3607)
(QTSR-2; AD-624597) CFSTI: HC $1.00/MF $0.50

Individual adaptive subsystems (as assigned to each of two participants) were provided to maintain optimum performance conditions for the participants concerned. An overall control system was provided to adjust the parameters of each of the subsystems to optimize group performance. The participants are continuously engaged in the conjoint skill of detecting and intercepting one of eight different trajectories. Experimental work is summarized. TAB

N66-15810*# Naval School of Aviation Medicine, Pensacola, Fla.
FACTORS CONTRIBUTING TO THE DELAY IN THE PERCEPTION OF THE OCULOGRAVIC ILLUSION
Brant Clark and Ashton Graybiel 13 Aug. 1965 23 p refs *Its* Rept.-120
(NASA Order R-93)
(NASA-CR-69562; NSAM-944) CFSTI: HC $1.00/MF $0.50 CSCL 05E

Five normal and eight labyrinthine defective men were studied in a Slow Rotation Room to observe the effects of factors which contribute to delay in change in perception of the horizontal following a change in direction of resultant force acting on a subject. Results showed very small effects of pre-exposure conditions prior to change in direction of resultant force. Delays in presentation of a luminous target following a change in resultant force and before settings to the visual horizontal occurred, however, produced major, systematic effects on the perception of the visual horizontal. Results are discussed in terms of the interaction of visual and gravitational cues in producing the lag effect. Author

N66-15833# Educational Testing Service, Princeton, N. J.
THE ROLE OF COGNITIVE FACTORS IN THE RECOGNITION OF AMBIGUOUS VISUAL STIMULI
John R. Frederiksen Jul. 1965 52 p refs
(Contract NONR-1858(15); Grant NSF G-22889)
(RB-65-23; AD-473580)

The effect of five cognitive abilities on the recognition of out-of-focus pictures was investigated using a factor extension procedure which is sensitive to differences among the slides in the abilities they require for recognition. In addition to recognition point measures, the subjects received scores reflecting their rate of hypothesis formation during the early stages of blur. The results indicated that the pictures did not all require the same cognitive abilities for their recognition. Nevertheless, some general effects of the cognitive abilities on slide recognition, which were independent of the particular picture, were also noticed. It was found that the ability to visualize (to transform the image of a spatial pattern into other visual arrangements) was negatively associated with early slide recognition, while Speed of Closure (the ability to unify an apparently disparate perceptual field into a single percept) was positively related to early recognition. It was also observed that visualizers tended to make fewer guesses about the blurred pictures than did nonvisualizers, while people who were high in Speed of Closure produced many initial hypotheses. It was found that the chances of recognizing early were greater for subjects who produced many initial hypotheses than for subjects who had few initial ideas. Author (TAB)

N66-15857# Naval Research Lab., Washington, D. C.
HUMAN VS FILTER AS DATA EXTRAPOLATOR IN A TWO-COORDINATE, SAMPLED-DATA TRACKING SYSTEM
C. L. Tipton 14 Oct. 1965 12 p refs
(NRL-6323; AD-624494) CFSTI: HC $1.00/MF $0.50

The performance of human operators was compared with that of a singly augmented filter in the continuous determination of the present position of a constant rate target moving in two coordinates. Target position was indicated intermittently in low, medium, or high noise levels and at low, medium, or high data rates. In addition, the target was subjected to a 10, 20, or 60 degrees course change in each trial. The filter evidenced less average tracking error in 23 of the 27 combinations of conditions of data rate, noise level, and course change. In twelve of these instances the filter was significantly superior at p = .02 level. Also, the results indicated increased error in human and filter performance as a function of increasing noise levels and decreasing data rates. Relative to the further enhancement of data extrapolation, several avenues of investigation recommend themselves. An immediate possibility is the employment of filter networks as an aid to the human operator. A second avenue of investigation is the study of more sophisticated filter designs. This experiment employed a filter of fixed time constant and fixed augmentation. An optimum filter would be of an 'adaptive' type, automatically adjusting its time constant and augmentation as a function of noise and data rate. Author (TAB)

N66-15858# North American Aviation, Inc., Columbus, Ohio.
TIME, UNCERTAINTY, AND INCENTIVE VARIABLES IN COMPOSITE TASK PERFORMANCE
John B. Feallock, Harry P. Bahrick, and George N. Ornstein 30 Sep. 1965 42 p refs
(Contract Nonr-4480(00))
(NA65H-913; AD-624830) CFSTI: HC $2.00/MF $0.50

Within complex man–machine systems, individual operators are commonly required to perform two or more functions concurrently. This report describes two empirical evaluations of the effects of variables common to complex systems upon the performance of a composite task comprised of two serial tasks. The first study investigated the effects of signal rate, signal duration and signal onset predictability upon performance accuracy and latency. Accuracy scores were reliably decreased by increased signal rate and increased onset predictability, although signal duration produced no reliable differences. Latency scores were insensitive to all three independent variables. In the second study, two variables were evaluated for their effects upon the accuracy of performance on the individual channels. One variable was the redundancy of signals on the second channel; the other was the ratio of incentive pay for the first and second channels. Performance improved reliably with signal redundancy for only the channel whose signal redundancy was increased. Different ratios of incentive pay did not produce reliable differences in performance for either channel, although certain trends were noted. Author (TAB)

N66-15859# Frost Engineering Development Corp., Englewood, Colo.
PERSONNEL RESTRAINT AND SUPPORT SYSTEM DYNAMICS
Peter R. Payne Wright-Patterson AFB, Ohio, AMRL, Oct. 1965 112 p refs
(Contract AF 33(657)-9514)
(AMRL-TR-65-127; AD-624487) CFSTI: HC $4.00/MF $0.75

Like any other complex dynamic system the human body responds in a complex way to acceleration inputs which vary rapidly with time. The need to avoid stresses large enough to cause injury to the body usually imposes limits on the permissible input acceleration. The restraint system interposed between a vehicle and its occupant can modify the physiological effects of a vehicle's acceleration–time history. This modification should be made as favorable as possible by minimizing the stresses generated in the vehicle's occupant. To determine optimum dynamic characteristics for the restraint system, its important characteristics, and those of the human body, need to be represented in terms of a mathematical or 'dynamic' model. Through suitable analysis, either mathematical or by means of a computer, those dynamic characteristics of the restraint system can be determined which will minimize the peak stresses developed in its human occupant. A general theory of suitable dynamic models is developed for this type of problem. Closed form solutions for a number of simple cases are presented. In addition a method is shown which permits development of simple dynamic models for the human body utilizing existing experimental data. Author (TAB)

N66-15865# Bell Helicopter Co., Fort Worth, Tex.
CONTACT ANALOG SIMULATOR EVALUATIONS: THE INFLUENCE OF SCREEN SIZE AND IMAGE FIELD OF VIEW
J. H. Emery and D. J. Dougherty Apr. 1965 33 p refs
(Contract Nonr-1670(00))
(D228-421-021; AD-624579) CFSTI: HC $2.00/MF $0.50

Measurement was made of the ability of four groups of pilots to perform a simulated rotary wing approach task under four display conditions of screen size and image field of view on the JANAIR contact analog vertical display. Two screen sizes tested were 6 inch square and 12 inch square. Measures of glideslope altitude, lateral track and airspeed control were recorded during the descent of the approach task. Flare overshoot, impact 'G' and final touchdown position were measured during the landing. Results indicate that image field of view did not differentially affect any of the six performance measures. Approach airspeed control was significantly better with the 12 inch square screen. Final touchdown position control was superior on the 6 inch square screen. None of the remaining performance measures were differentially affected by screen size. It was concluded that

pilot subjects with no previous training on the contact analog could adapt to the display condition that each was assigned, but it is recommended that a 1:1 relationship with the real world be used if intermittent VFR-IFR flight were in force or if it were desirable to superposition other information such as television or radar on the contact analog. Author (TAB)

N66-15893# Human Engineering Labs., Aberdeen Proving Ground, Md.

HUMAN FACTORS ENGINEERING DESIGN STANDARD FOR MISSILE SYSTEMS AND RELATED EQUIPMENT

Robert F. Chaillet Sep. 1965 254 p

(HEL-S-3-65; AD-623731) CFSTI: HC $6.00/MF $1.25

The purpose of the Standard is to provide human factors engineering design principles and detailed criteria. The design principles are expressed as general rules applicable during missile system research and development programs, or as essential items to be considered during design, to insure the incorporation of sound human factors engineering practices. The detailed criteria consist of dimensions, ranges, tolerances and other specific data. The range of acceptable dimensions and other factors may be rather large in some cases. TAB

N66-15914# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.

THE SLOW NEUTRON CALIBRATION OF FILM AND OTHER GAMMA DOSIMETERS

S. J. Boot and J. A. Dennis Aug. 1965 21 p refs

(AERE-R-4960) HMSO: 3s

The slow neutron calibration of a film dosimeter was determined for exposures in free air and on the surface of a tissue equivalent chest phantom. The slow neutron and gamma flux determinations associated with the film measurements are described in detail. Equations are derived from which neutron and gamma doses may be found from film densities and the errors involved are given. Slow neutron and gamma flux reflection caused by the phantom is discussed with reference to results of depth dose calculations. Author

N66-16015# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

THE ELECTRORETINOGRAPHIC RESPONSE TO WEAK STIMULI OF LARGE SUBTENSE

N. M. J. Schweitzer and A. Troelstra [1965] 22 p

(IZF-1965-15; TDCK-43437) CFSTI: HC $1.00/MF $0.50

If a stimulus of large subtense and low intensity, e.g. 100 times above the absolute visual threshold, is presented to the dark adapted eye, the resulting ERG-response shows several fast positive components, followed by a slow negative deflection. The number of the positive components depends mainly on the duration of the flash. The first component is hardly affected by changes in the intensity of the flash; the second and following ones show, within the intensity range studied, a linear dependency and the latter therefore determine the amplitude and shape of what is called the normal scotopic b-wave. This linearity also accounts for the excellent responses one can obtain at intensity levels very near the differential visual threshold. Apart from the way light adaptation affects the several components we have also devoted attention to the response on a dark flash and to the influence exerted by dark adaptation and the subtense of the stimulus field. Author

N66-16065# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

A STUDY OF THE MECHANICS OF HUMAN BALANCING FOR POTENTIAL APPLICATION TO THE CONTROL OF VEHICLES. PART I: INITIAL INVESTIGATION OF VERTICAL BALANCING IN EARTH GRAVITY

T. Keller, J. O'Hagan, and R. Weston Oct. 1965 30 p ref (RM-299)

This is a report of progress in a continuing program of basic research into the mechanics of human balancing viewed as a closed loop dynamic process. The program is being conducted in conjunction with a NASA sponsored study of vehicular control using the human balancing reflex. Its ultimate objective is a general mathematical model of the balancing process. Initial work has been concerned with natural, fore-and-aft balancing on a simulated force-vector supported platform under conditions of earth gravity. Several kinds of experimentation and analysis procedures have been tried and a number of hypotheses concerning such items as the relative roles of vision and proprioception in the balancing process, the effect of body flexibility, and the response to disturbing inputs have been qualitatively tested, but only a small amount of data suitable for mathematical analysis has so far been collected. The following, tentative conclusions about the balancing process have been drawn: (1) it is completely subconscious and varies little between people; (2) it is not significantly affected by body flexibility; (3) it has a short period and a long period component, essentially uncoupled and operating through different sensing mechanisms; and (4) its short period response is essentially a simple, damped sine wave. Author (TAB)

N66-16100# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

HUMAN PERFORMANCE DURING VIBRATION

Charles S. Harris and Richard W. Shoenberger Nov. 1965 28 p refs Presented at Autonetics and ONR Joint Symp. on Visual and Display Problems of High Speed Low Altitude Flight, Anaheim, Calif., 3–5 Mar. 1964

(AMRL-Memo-P-73; AMRL-TR-65-204; AD-624196) CFSTI: HC $2.00/MF $0.50 CSCL 06B

The report discusses the experimental approaches to the study of human performance during vibration. In addition, the characteristics of mechanical bodily responses to vibration at different frequencies are discussed, and human performance studies of the effects of vibration are compared with recommended long time tolerance curves. Author (TAB)

N66-16124* Douglas Aircraft Co., Inc., Santa Monica, Calif.

SPACE-BASED CENTRIFUGE

William J. White *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 209–213 (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Engineering and biomedical studies are in progress to define the research, therapeutic and training potential of a space-based centrifuge. A brief review of these studies indicates: (a) the short-radius centrifuge is the only practical method of producing a valid acceleration in space; (b) that a steep head-to-foot acceleration gradient neither precludes the measurement of tolerance to positive acceleration nor do the high rates of rotation produce motion sickness problems for the well-trained individual; (c) cardiovascular deterioration produced by recumbency is largely prevented by periodic centrifugation. Author

N66-16127* General Electric Co., Houston, Tex.
PHYSIOLOGICAL DESIGN CRITERIA FOR ARTIFICIAL GRAVITY ENVIRONMENTS IN MANNED SPACE SYSTEMS
Allen B. Thompson *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 233–241 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Indications of undesirable environmental adaptations during conditions of weightlessness have led to experiments to find practical means for exercising the affected systems to prevent atrophy. For example, the cardiovascular system can be exercised by applying interconnected tourniquets to the four extremities, connected to an air source, and compressed and released at short intervals. In six-hour tests in a water immersion facility, orthostatic tolerance as determined by tilt table was normal or better than the one G controls. The encumbrances and the power required for such exercise are considered undesirable. A systematic calisthenic program and a carefully controlled diet are basics to prevent muscular atrophy and reduce decalcification of the skeleton. A practical method to achieve artificial gravity is described. Drawbacks are (1) the generation of coriolis acceleration and (2) gyroscopic torque stimulation of semicircular canals when angular motion is attempted outside the plane of rotation. M.W.R.

N66-16130* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME OBSERVATIONS ON THE STIMULATION OF THE VESTIBULAR SYSTEM OF MAN IN A ROTATING ENVIRONMENT
Ralph W. Stone, Jr. and William Letko *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 263–278 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Experimental results indicate that the effects experienced in a rotating spacecraft are best simulated by orienting a subject with his long body axis perpendicular to the axis of rotation of the vehicle. Considerable variation in semicircular canal stimulation is indicated for persons with normal vestibular functions, although most subjects can tolerate 10 rpm. Performance and tolerance to rotation do not appear to be effected by the radius of rotation. In the body position used in this experiment, tilting back the head caused some subjects to be less tolerant to motion. Experiments were made in a simple rotating-vehicle simulator with the centrifugal force taken on the soles of the feet as it would occur in a rotating space vehicle. Twenty-nine subjects were used for head turning experiments, nine participated in nodding experiments, and 10 were used to study combined motions. Tolerance, response times, and rates are plotted for various parts of the experiment. M.W.R.

N66-16131* General Dynamics/Astronautics, San Diego, Calif.
OBSERVATIONS ON SUBJECTS EXPOSED TO PROLONGED ROTATION IN A SPACE STATION SIMULATOR
Bernard D. Newsom and James F. Brady *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 279–292 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

Rotating space vehicle design and task analysis require biofunctional guidelines based upon the integrated information of all levels of vestibular physiologic research, with final criteria determined by the measure of crew performance as a function of controlled environmental changes in a realistic space vehicle simulator. The Manned Revolving Space Station Simulator (MRSSS) at GD/Convair is the result of this concept and allows adjustments in radius, angular velocity, force field and stability. As a baseline study for projected investigations of the stability requirements of a rotogravic system, four subjects performed a comprehensive array of psychologic and physiologic tests during five days of continuous rotation at 6 rpm in the MRSSS. Subjects adjusted completely to the environment, required little post-spin readaptation and showed minor performance decrement. Paper discusses importance of stability as a design parameter and the five-day test program and results. Author

N66-16133* Umea Univ. (Sweden). Medical School.
STEPWISE ADAPTATION TO A VELOCITY OF 10 RPM IN THE PENSACOLA SLOW ROTATION ROOM
Martin Bergstedt *In* NSAM The Role of the Vestibular Organs in the Exploration of Space 1965 p 339–345 refs (See N66-16106 06-04) GPO: HC $2.25; CFSTI: MF $2.00

As a result of three experiments conducted in a slow rotation room (SRR), a stepwise procedure appears to be desirable for adapting to a velocity of 10 rpm. Steps of 2 to 3 rpm are recommended, and it is found difficult to reach or adapt to 10 rpm in less than five days. Even with stepwise adaptation, the 10 rpm level is considered difficult and stressing. The rotating chair, mounted in the SSR, permitted oculogyral illusion testing and Coriolis nystagmus recording, and could be used to estimate adaptation to each of the velocity levels. Profiles of the three experiments are illustrated. M.W.R.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N66-15280*# Thiokol Chemical Corp., Denville, N. J. Reaction Motors Div.
GELLING OF LIQUID OXYGEN FLUORIDE Final Report, 18 Nov. 1963–17 Nov. 1964
A. J. Beardell Dec. 1965 39 p refs
(Contract NAS3-4180)
(NASA-CR-54220; RMD-5039-F) CFSTI: HC $2.00/MF $0.50 CSCL 21I

A study was performed to gel liquid oxygen difluoride, to characterize the candidate system, and to determine its mechanical and chemical stability. Inorganic fluorides and oxides were screened as possible OF_2 gellants and Cab-O-Sil, a pyrogenic silica, was chosen as the candidate gellant. OF_2 was also gelled with Alon C and TiO_2 although the gels did not appear to be of comparable quality. The OF_2–Cab-O-Sil gel was evaluated for thermal stability, mechanical stability, evaporation rate relative to liquid OF_2 and shock sensitivity, and was shown to have satisfactory characteristics. Author

N66-15302 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF PRODUCTS OF COMBUSTION OF METHANE-AIR MIXTURE BY THE GAS CHROMATOGRAPHY METHOD
V. N. Abramov and V. I. Fisak *In its* Plant Lab. 28 Sep. 1965 2 p (See N66-15301 06-34) CFSTI: HC $1.00/MF $0.50

A column of diameter of 5.5 mm and 120 cm length, filled with grade ShSK silica gel with grains of 0.25 to 0.5 mm, was designed for separation of carbon dioxide. A column of a diameter of 5 mm and 80 cm length filled with activated charcoal, grade AG-5 or SKTM-D, with grains of 0.25 to 0.5 mm was

designed for separating the combustible components. The flow of the gas carrier was 0.42 to 0.46 liter/min. Analysis was performed in two stages. The tested mixture was placed in two samplers with a capacity of 20 milliliters, one of which is designed for analysis of carbon dioxide, and the other for analysis of combustible gases. The first sampler was connected to the instrument for the determination of the concentration of carbon dioxide; then, the column, detectors, and feed line were connected for the analysis of combustible gases, and the gas from the second sampler was analyzed. The EPP-09 instrument was used for detector signal registration with duration of carriage travel along the scale of 1 sec. The concentration of gas in the analyzed mixture was determined by the peak value on the chromatogram by means of calibration curves. It was found that the total duration of analysis is less or equal to 3 min. The deviation is 1.5 to 2%. Further, the instrument determines the quantity of gas in the mixture with an accuracy up to 10^{-3}%. R.R.D.

N66-15303 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

QUANTITATIVE X-RAY ANALYSIS OF CARBIDES AND NITRIDES OF TITANIUM, ZIRCONIUM AND HAFNIUM

Yu. V. Levinskii *In its* Plant Lab. 28 Sep. 1965 4 p ref (See N66-15301 06-34) CFSTI: HC $1.00/MF $0.50

A method is proposed for quantitative X-ray analysis of carbides and nitrides of titanium, zirconium and hafnium based on the linear variation of the parameter of the lattice of solid MeN–MeC. The compounds should not contain oxygen. The results of X-ray and chemical analyses conform. Author

N66-15328# Minnesota Univ., Minneapolis.

INDUCTION OF CONTRACTILE PROPERTIES IN MACROMOLECULAR SUBSTANCES BY LIGHT Final Report, Feb. 19, 1963–Jun. 30, 1965

Rex Lovrien [1965] 5 p refs

(Contract DA-31-124-ARO(D)-88)

(AROD-4145-2; AD-623475) CFSTI: HC $1.00/MF $0.50

A summary is given of work involving the design and study of polymer systems in which the macro-molecules reversibly change their dimensions by light, and also the outline of some of the chemistry of the interaction of isomerizable chromophores with polymers which bind them. TAB

N66-15333# Frankford Arsenal, Philadelphia, Pa. Quality Assurance Directorate.

DETERMINATION OF ETHYLENE DIMETHACRYLATE (ETHYLENE GLYCOL DIMETHACRYLATE) IN NITROCELLULOSE-BASE PROPELLANTS BY SAPONIFICATION, BROMINATION, AND INFRARED

George Norwitz and Julius B. Apatoff Mar. 1965 28 p refs (T65-12-1; AD-615171) CFSTI: HC $2.00/MF $0.50

Ethylene glycol dimethacrylate is determined in nitrocellulose-base propellants by saponification, bromination, and infrared. In the saponification method the ethylene dimethacrylate is saponified after extraction with methylene chloride. A slight correction should be made for the nitration products of diphenylamine which react with alkali. In the bromination method the ethylene dimethacrylate is determined by titration with potassium bormate after extraction with methylene chloride. A correction must be made for diphenylamine which is also brominated. Diphenylamine in propellants containing ethylene dimethacrylate must be determined after a steam distillation, using either the gravimetric or titrimetric bromination technique; it cannot be determined gravimetrically in the solvent extract because of interference by ethylene dimethacrylate. In the infrared method the ethylene dimethacrylate is extracted with methylene chloride and the ester peak at 5.78 microns is measured in the methylene chloride solution. The saponification, bromination, and infrared methods give approximately the same results. Author (TAB)

N66-15422*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.

TIME-DEPENDENT REACTIONS OF THE CRYSTALLIZING AND SOLIDIFYING OF LINEAR HIGH POLYMERS [ZEITABHANGIGE VORGANGE DES KRISTALLISIERENS UND ERSTARRENS BEI LINEAREN HOCHPOLYMEREN]

Bernard Wunderlich [1965] 8 p refs In GERMAN Submitted for Publication

(Grant NsG-100)

(NASA-CR-60393) CFSTI: HC $1.00/MF $0.50 CSCL 07C

Delayed molecular rotations of polyethylene crystals were studied by electron microscopy. Crystals formed at high pressures, high crystallization temperatures, and slow crystallization times showed higher interior temperatures than surface temperatures in their melting phases. Crystal growth at pressures exceeding 4000 atm. formed specimens consisting of multiple molecular chains with a spherulite morphology; their large surface planes resulted in reduced melting points. It was concluded that the thermodynamic stability of polyethylene crystals depended on the applied growth temperature and time. A fast crystallization process resulted in dendrite crystals with increased lattice defects and higher electron transfer rates. Transl. by G.G.

N66-15424*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.

SEARCH FOR OPTICAL ACTIVITY IN THE ORGUEIL METEORITE

Ryoichi Hayatsu Dec. 1964 24 p refs Submitted for Publication

(Grant NsG-366)

(NASA-CR-60312; EFINS-64-67) CFSTI: HC $1.00/MF $0.50 CSCL 07B

Experiments, undertaken to verify the existence of optical activity in the Orgueil carbonaceous chrondrite, are described. Previous data indicated a rotation of $-0.023° \pm 0.005°$ in an extract consisting mainly of organic acids and hydrocarbons. Samples, free of fusion crust and visible surface contamination, were obtained, and the original procedure was modified to eliminate sulfur and to separate hydrocarbons from acidic compounds. Infrared and ultraviolet spectrophotometry were used as analytical techniques, and the principal absorption maxima of the samples, and their methyl esters are tabulated. Comparison with the original findings showed good agreement. Compositional differences in both sets of samples are noted, and the controls employed are discussed. Measurements were performed on three different polarimeters, and the samples investigated showed no significant optical rotation at 440 mμ. It was concluded that the presence of optically active compounds was not confirmed as (1) none of the several fatty acid and hydrocarbon fractions measured gave a rotation exceeding that of optically inactive controls; and (2) the highest value observed, $-0.0024°$, is an order of magnitude lower than the rotation previously observed. M.G.J.

N66-15461# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).

DIFFERENCES IN ANTHRACENE OIL RADIOLYSIS BY γ RADIATION AND BY FAST NEUTRONS [DIE UNTERSCHIEDLICHE ZERSETZUNG VON ANTHRAZENOL DURCH GAMMASTRAHLUNG UND SCHNELLE NEUTRONEN]

E. Proksch and F. Wiesinger [1965] 32 p refs In GERMAN; ENGLISH summary Submitted for Publication

(SGAE-CH-19/1965) CFSTI: HC $2.00/MF $0.50

Measurements in a reflector position have been used in combination with earlier measurements in the center of the core to extrapolate the radiolytic decomposition of anthracene oils by pure γ radiation and fast neutrons, respectively. The G_γ^0 values are independent of temperature: $G_\gamma^0(\rightarrow HBR) = 0.22 \pm 0.04$, $G_\gamma^0(gas) = 0.016 \pm 0.010$. $G_n^0(\rightarrow HBR)/G_\gamma^0(\rightarrow HBR)$ increases from 2.6 ±0.5 at 200 to 275° C to 5.1 ±1.0 at 380° C. $G_n^0(gas)/G_\gamma^0(gas)$ increases from 7 ±4 at 200° C to 20 ±12 at 380° C. Parallel measurements using a terphenyl mixture for comparison yielded a $G_\gamma^0(\rightarrow HBR)$ of about 0.15 and a $G_n^0(\rightarrow HBR)$ of about 0.30, both independent from temperature in the range of 275 to 350° C. Radiolytic tar (HBR, high boiling residues) from anthracene oil has been found to decompose back to anthracene oil when pyrolyzed at temperatures higher than the temperature during radiolysis. Author

N66-15462# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).

THE RADIATION STABILITY OF ANTHRACENE OILS. PART II: PILE RADIOLYSIS AT 150 TO 380°C [DIE STRAHLENBESTANDIGKEIT VON ANTHRAZENOLEN II. RADIOLYSE IM KERNREAKTOR BEI 150 BIS 380°C]

E. Proksch, F. Wiesinger, H. Eschweiler, and W. Szinowatz [1965] 22 p refs In GERMAN; ENGLISH summary Submitted for Publication

(SGAE-CH-20/1965) CFSTI: HC $1.00/MF $0.50

The radiolytic decomposition of anthracene oils in a nuclear reactor has been studied using two different fast neutron dose fractions. Assuming additivity of the effects one may extrapolate from the two series of experiments that the decomposition caused by fast neutrons is higher by a factor of about 2.5 to 5 than by γ-radiation. The stability of different oils decreases with increasing fraction of non-aromatic protons. The dependence of dose of the decomposition follows a second-order rate law. The main decomposition products are dimeres to tetrameres of the original hydrocarbons. Author

N66-15529# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

APPLICATION OF CONTROLLED-POTENTIAL COULOMETRY TO DETERMINATIONS IN RADIOACTIVE SOLUTIONS. CASE OF FISSION-PRODUCT AND IRRADIATED-FUEL SOLUTIONS [APPLICATION DE LA COULOMETRIE A POTENTIEL CONTROLE A DES DETERMINATIONS DANS DES SOLUTIONS RADIOACTIVES CAS DES SOLUTIONS DE PRODUITS DE FISSION ET DES COMBUSTIBLES IRRADIES]

A. Denis (Ph.D. Thesis—Paris Univ.) Brussels, EURATOM Nov. 1965 180 p refs In FRENCH; ENGLISH summary

(Contract EURATOM-025-62-10 RISF)

(EUR-2618.f) CFSTI: HC $5.00/MF $1.00

The object of this work is to study the technique of analysis by controlled-potential coulometry is applied to determinations in highly active solutions. Coulometric determinations were carried out in connection with the analysis of four elements: uranium, molybdenum, chromium and iron. Determination of the H_2O_2 formed in the fission-product solutions was likewise undertaken, together with the application of this method as a means of checking the extraction yield (case of I-129). Author

N66-15533# Brookhaven National Lab., Upton, N. Y.

GAMMA-RADIATION-INDUCED POLYMERIZATION OF ETHYLENE

L. E. Kukacka, P. Colombo, and M. Steinberg [1964] 24 p refs (BNL-9104)

The kinetics and product characteristics of the Co^{60} gamma-radiation-induced polymerization of ethylene have been studied as a function of pressure, radiation intensity, and temperature. Experiments were carried out under conditions which ranged in pressure from 170 to 1360 atm, in temperature from 20° to 200° C, and in radiation intensity from 5.8×10^4 to 8.5×10^5 rads/hr. Activation energies of 0.2 and 14.5 kcal/mole were determined for the temperature ranges 20° to 100° C and 120° to 200° C, respectively. Empirical relationships for the rate of polymerization and the radiation yield for the range of pressure and radiation intensity studied and for temperatures between 20° and 100° C, are given. The polymers produced over the entire range of conditions were found to be completely soluble. Densities ranged from 0.95 g/cc for material formed at 20° C to 0.91 g/cc for material formed at 120° C. The weight average molecular weight decreased from 1.5×10^6 to 4.7×10^4 over the same temperature range. The molecular weight was found to increase with pressure and with decreasing radiation intensity. All polymers formed at temperatures below 120° C had a melt index of <0.06 g/10 min. Author

N66-15560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECTROPHOTOMETRIC INVESTIGATION OF REACTION OF NIOBIUM AND TANTALUM WITH SALICYLHDROXAMIC ACID

I. P. Alimarin and N. P. Borzenkova 12 Oct. 1965 17 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. II: Khim. (Moscow), no. 6, 1963 p 65–69

(FTD-TT-65-920/1+2+4; AD-622461) CFSTI: HC $1.00/MF $0.50

A method is described whereby the amount of niobium in the presence of tantalum may be determined by measurement of the absorption spectrum. Salicylohydroxamic acid is used, and the solution may be strongly acidic with H_2SO_4. The strongly acidic solutions are convenient for determination of niobium in alloys. TAB

N66-15582# Bureau of Mines, Minneapolis, Minn. Metallurgy Research Center.

REDUCTION OF FERROUS OXIDE (WUSTITE) AT HIGH TEMPERATURES

J. P. Hansen, T. N. Rushton, and S. E. Khalafalla 1966 33 p refs

(BM-RI-6712)

Wustite beds were reduced with carbon monoxide and mixtures of hydrogen and nitrogen in the temperature range 900° to 1300° C to determine the effect of temperature, gas flow, and surface area on the rate of reduction to iron. The composition of the gas stream as it passed through the wustite bed was continuously measured with infrared absorption cells and heated-wire methods. The change in composition was used to calculate the reaction rates. Arrhenius plots of the data give heats of activation of 34 kcal for particles using CO, 27 kcal for particles using H_2, 24 kcal for pellets using CO, and

6 kcal for pellets using H_2. The velocity of reduction is dependent on the area of reacting interface and the driving potential of the gas (reducing gas concentration minus equilibrium concentration) as well as the exponential temperature effect. The reaction rate was independent of the gas velocity over the range of conditions studied. Author

N66-15607# Naval Air Development Center, Johnsville, Pa. Aero-Electronic Technology Dept.
STUDY OF SILVER CHLORIDE LUMINESCENCE Final Task Report
Donald Promish 8 Oct. 1965 24 p refs
(NADC-AE-6514; AD-622787) CFSTI: HC $1.00/MF $0.50

The study was prompted by the possibility of using AgCl as an infrared detector. The report presents data on the luminescence of a solid, polycrystalline sample of silver chloride. Monochromatic ultraviolet light was used to excite the sample, whose luminescence spectrum was examined at temperatures of 300° and 77° K and wavelengths ranging from 200 to 800 millimicrons (mμ). Several incident ultraviolet wavelengths, ranging from 200 to 300 mμ, were used. Two luminescence peaks were observed. One of them diminished upon cooling the sample from 300° to 77° K, and has been ascribed to the fused quartz wall of the sample holder. It is concluded that fused quartz might be a good infrared detector, and that silver chloride is not responsive to thermal effects at the wavelengths studied. TAB

N66-15619# India. Dept. of Atomic Energy, Bombay.
SPECTROPHOTOMETRIC DETERMINATION OF URANIUM WITH 8-HYDROXYQUINOLINE IN ACETONE–PYRIDINE MEDIUM
K. S. Koppiker and K. B. Gajankush 1965 22 p refs
(AEET-225) CFSTI: HC $1.00/MF $0.50

A method has been described for the spectrophotometric determination of uranium in acetone medium using 8-hydroxyquinoline. Addition of a base like pyridine has been found to reduce reagent blank and enhance color of uranium. Optimum concentrations of reagent and pyridine have been found and the procedure has been applied for the analysis of impure aqueous solutions and low grade ore samples. For the elimination of interference due to other ions, an ethyl acetate extraction of uranium from a solution nearly saturated with aluminum nitrate has been recommended. The color is then developed using an aliquot of the ethyl acetate extract. Author

N66-15622# India. Dept. of Atomic Energy, Bombay.
ISOTOPIC EXCHANGE IN THE SOLID STATE AND THERMAL ANNEALING OF RECOIL DAMAGE IN COBALT COMPLEXES
Amar Nath, S. Khorana, P. K. Mathur, and S. Sarup Jun. 1965 11 p refs
(AEET-216) CFSTI: HC $1.00/MF $0.50

Isotopic exchange was investigated for several cobalt complexes and it was found that the open-type complexes showed little exchange while others exhibited a large amount of exchange. The isotopic exchange is presumably preceded by capture of free electrons by Co^{++} species and therefore the exchange is determined by the rate of release of electrons from traps or valence bands. A few drops of high specific $^{60}Co^{++}$ activity in aqueous medium were added to samples of cobalt complexes. The open-type complexes show little exchange at the temperatures at which they are stable. This is in harmony with the fact that they exhibit little thermal annealing after (n,γ) or (γ,n) reactions. Exchange is considerably retarded in the presence of oxygen. In the case of $CoTS_2Cl \cdot 2\,H_2O$ and $NaCoY \cdot 4\,H_2O$ the rate of isotopic exchange decreased sharply after the first few minutes of heating because of the dehydration of the complexes. The existence of trapped electrons has been postulated for cobalt complexes as they exhibit marked oxygen effect. The close resemblance between the phenomenon of isotopic exchange in the solid state and the annealing of recoil-damage is strongly suggestive of the fact that the majority of the recoil atoms stabilize as simple bivalent cobalt ions. E.E.B.

N66-15637# Royal Aircraft Establishment, Farnborough (England).
VARIATION WITH TEMPERATURE OF THE INFRA-RED SPECTRUM OF POLYVINYL CHLORIDE. PART II. BEHAVIOR IN THE REGION OF THE GLASS TRANSITION TEMPERATURE
Koji Fukawa Aug. 1965 22 p refs Transl. into ENGLISH from J. Soc. Chem. (Japan), v. 66, no. 11, 1963 p 1605–1609
(RAE-LIB-TRANS-1127) CFSTI: HC $1.00/MF $0.50

The infrared spectra of samples of polyvinylchloride, chlorinated polyvinylchloride and polystyrene were recorded at different temperatures. A change in second temperature derivative of absorbance was observed for certain bands and the temperature at which this occurred was in agreement with glass transition temperatures obtained dilatometrically. The glass transition temperatures of chlorinated polyvinylchloride, obtained dilatometrically, increased with increasing chlorine content. From measurements of absorbance ratios, D_{690}/D_{635} and D_{690}/D_{615} it was deduced that the degree of chain rotation increased above the glass transition point. Author

N66-15649# Naval Research Lab., Washington, D. C.
PHOTODEGRADATION OF HIGH POLYMERS. PART VII: PHOTOLYSIS OF POLY(n-BUTYL METHACRYLATE) IN VACUUM
L. G. Isaacs and R. B. Fox 14 Oct. 1965 21 p refs
(NRL-6339; AD-624303) CFSTI: HC $1.00/MF $0.50

The photodegradation of poly(n-butyl methacrylate) from three sources has been studied. At 100° C, samples lost 90 to 95% of their original weight after about 30 hr of exposure and left about 4% insoluble polymer. At 50° C, about half as much material was volatilized, and one fourth was left insoluble. Most of the volatile products consisted of n-butyl methacrylate (monomer), n-butyl formate, and 1-butene; lesser amounts of n-butyraldehyde, 1-butanol, n-butane, and carbon dioxide were also produced. Increasing the temperature increased the relative yield of monomer, and, except for 1-butene, decreased the relative yields of the other products. Although films degraded at 100° C showed nearly complete volatilization, a sample exposed at 50° C and then re-exposed at 100° C showed little additional volatilization at the higher temperature. This suggests that more crosslinking occurs at the lower temperature. The volatile products other than monomer are accounted for by cleavage reactions of the pendent ester groups, with subsequent hydrogen abstraction or disproportionation of the free radicals. Monomer results from main chain cleavage followed by depolymerization; this reaction predominates at the higher temperature. Author (TAB)

N66-15683# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
25 YEARS OF NUCLEAR FISSION. METHODS AND RESULTS OF CHEMICAL STUDIES. I: HISTORICAL BACKGROUND, FISSION PRODUCTS

G. Herrmann May 1965 49 p refs Transl. into ENGLISH from Radiochimica Acta, v. 3, 1964 p 169–185
(AERE-TRANS-1036) HMSO: 6s

Basic definitions, fission chains, products of ternary fission, and unidentified fission products are considered in a 25-year review of chemical studies on low energy fission of heavy nuclei. Tables contain both fission products as well as nuclides which are thought to be fission products; shielded nuclei are listed only if their detection appears possible; and an extensive listing of references relating to fission chains is included. Half-lives of unidentified fission products are tabulated. It is concluded that the search for fission products by radiochemical methods is essentially completed. Special methods are required to unearth nuclides with half-lives of a few seconds from complex fission product mixtures. M.W.R.

N66-15686# United Kingdom Atomic Energy Authority, Harwell (England).
REPROCESSING WITH AMINE ETHER SYSTEMS. PART 3: COUNTER-CURRENT TRIALS WITH ALAMINE 336–DIBUTYL CELLOSOLVE
R. J. W. Streeton and M. J. Holdoway Aug. 1965 33 p refs
(AERE-R-4440, Pt. 3) HMSO: 4s

Fifteen percent (0.30M) Alamine 336/DBC has been tested in the reprocessing of fast reactor fuel for the separation of plutonium from uranium and fission products. Miniature mixer-settler runs, using either uranium(IV) as a stand-in for plutonium, or plutonium(IV) have been carried out. Good separations of uranium(IV) and uranium(VI) can be achieved, without using excessive volumes of solvent and scrub, because concentrations up to 16–17 g uranium(IV)/l in the amine phase can be obtained. With plutonium(IV) the limiting concentration in the amine phase is only 10.5 g plutonium(IV)/l. The behavior of zirconium/niobium and ruthenium was investigated, and it has been found for ruthenium that only the tetranitrato nitrosylruthenium cannot be scrubbed out of the solvent. Decontamination factors of 240 and 42 have been obtained for zirconium/niobium and ruthenium respectively. Backwashing of uranium(IV) or plutonium(IV) from the amine phase was satisfactorily carried out with 1M acetic acid containing 0.05M HNO_3. Author

N66-15711# Naval Research Lab., Washington, D.C. Chemistry Div.
SURFACE CHEMISTRY OF FLUOROCHEMICALS
N. L. Jarvis and W. A. Zisman 21 Oct. 1965 37 p refs
(NRL-6324; AD-624610) CFSTI: HC $2.00/MF $0.50

With the advent of the highly fluorinated organic compounds, it has been possible to prepare surfaces having extremely low free surface energies, much lower than had previously been possible with hydrocarbon derivatives. Because of their low surface energies, fluorinated solids have the most nonwettable and nonadhesive surfaces known. It has been proved that only the outermost molecules of the surface of a solid need be highly fluorinated in order to achieve such low surface energies. In fact the most nonwetting surfaces studied to date were those covered with an adsorbed monolayer of closely packed perfluoro acids, with the perfluoromethyl ($-CF_3$) groups outermost. It has likewise been found that surface-active agents containing perfluorocarbon terminal groups will lower the surface tension of water far below the values obtainable with hydrocarbon-type wetting agents. Certain fluorinated hydrocarbon derivatives have also been synthesized that show very high surface activity in a wide variety of organic liquids, the extent of surface activity being dependent upon the organophilic-organophobic balance in the fluorine-containing amphipathic molecule. Author (TAB)

N66-15716# Idaho Univ., Moscow.
NEW HYPOFLUORITES CONTAINING NITROGEN Quarterly Technical Report No. 6
Jean'ne M. Shreeve 1 Jan. 1965 5 p
(Contract Nonr-4217(00); ARPA Order 442)
(AD-624641) CFSTI: HC $1.00/MF $0.50

The fluorination study of trifluoronitrosomethane in the presence of a AgF_2 catalyst has now been completed. Conditions of concentration, time of irradiation, and other experimental conditions were varied in an attempt to obtain as high a yield of NF_2COF as possible from the irradiation of CO and N_2F_4. In a continuation of attempts toward the preparation of nitrogen-containing hypofluorites, preparation of some perfluoro compounds which could be used as starting materials were investigated. TAB

N66-15758# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ULTRA PURE SUBSTANCES. ANALYTICAL CHEMISTRY OF TRACES
I. P. Alimarin 15 Sep. 1965 15 p Transl. into ENGLISH from Priroda (Moscow), no. 9, 1963 p 27–31
(FTD-TT-65-699/1+2+4; AD-621799) CFSTI: HC $1.00/MF $0.50

A review is given of applications and methods of chemical analysis of trace elements in various substances. TAB

N66-15778*# Oklahoma State Univ. Research Foundation, Stillwater. Dept. of Physics.
SURFACE PARAMETERS OF STANNIC OXIDE IN POWDER, CERAMIC, AND GEL FORM BY NITROGEN ADSORPTION TECHNIQUES Interim Report
J. L. Rutledge, E. E. Kohnke, and C. M. Cunningham Dec. 1965 74 p refs
(Grant NsG-609)
(NASA-CR-69548; SS-2) CFSTI: HC $3.00/MF $0.75 CSCL 07D

A conventional gas adsorption apparatus employing 32 volumes differing by about 8 cm^3 in the calibrated bulb system was constructed and used to measure the volume of nitrogen adsorbed as a function of pressure on three forms of SnO_2—powder, ceramic and gel—at 78° K. The specific surface of each sample was calculated from each isotherm according to the B.E.T. equation and geometric considerations resulting in the following areas: (1) SnO_2 Powder (Reagent Grade)—2.0 m^2/gm; (2) SnO_2 Ceramic (Low Density)—0.37 m^2/gm; and (3) SnO_2 Gel (Ion-free)—173 m^2/gm. In addition, the adsorption isotherms have been analyzed to determine the nature of the surfaces with respect to pores and capillaries. For the ceramic specimen, a type II isotherm with no hysteresis indicates pore radii greater than 300 Å. The gel exhibited a type I isotherm with no hysteresis suggesting small capillaries of molecular dimensions (i.e., 20Å). The powder sample exhibited a type II isotherm without hysteresis indicating that no significant number of small pores are present in each grain. A spherical particle model for the powder and a similar spherical pore model for the ceramic yielded particle and pore size consistent with the shapes and magnitudes of the measured isotherms. Author

N66-15787*# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
RESEARCH AND DEVELOPMENT OF A HIGH CAPACITY NONAQUEOUS SECONDARY BATTERY Fourth Quarterly Report, Jul.–Sep. 1965

R. G. Selim, K. R. Hill, and M. L. B. Rao 11 Nov. 1965 91 p (Contract NAS3-8017)
(NASA-CR-54874) CFSTI: HC $3.00/MF $0.75 CSCL 07D

The individual processes and phenomena attending secondary cell operation are discussed and experimental data presented concerning lithium deposition and cycling, ionic solvation, cathode construction and discharge efficiency, and solvent purification. Solvents of particular interest are propylene carbonate, butyrolactone, dimethylformamide, dimethylsulfoxide, and acetonitrile. Author

N66-15792*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEPENDENCE OF SURFACE CONDUCTIVITY OF SODIUM CHLORIDE ON THE CHEMICAL NATURE OF THE SURFACE
Charles E. May and John P. Jayne Washington, NASA, Feb. 1966 20 p refs
(NASA-TN-D-3236) CFSTI: HC $1.00/MF $0.50 CSCL 07D

The surface conductivity S of sodium chloride was measured near room temperature as a function of the partial pressure of water vapor P, absolute temperature T (over a 20° range), and surface treatements. For all specimens,

$$\log S = \log S_0 + \frac{\alpha' P}{T^{-11}}$$

where S_0 is the extrapolated value of surface conductivity at zero water pressure and α' for treated surfaces is in general about 40 percent greater than the value for as-cleaved surfaces. The values of S_0 vary as follows: S_0 (deuteroxide surface) > S_0 (hydroxide surface) > >. S_0 (carbonate surface), S_0 (compact > > S_0 (melt-grown single crystal) ≥ S_0 (natural crystal). The work confirms the existence of hydroxide and carbonate groups on the surface of sodium chloride. Author

N66-15836# National Defense Research Organization T.N.O., The Hague (Netherlands). Chemical Lab.
STEREOSPECIFICITY OF HYDROLYTIC ENZYMES IN THEIR REACTION WITH OPTICALLY ACTIVE ORGANOPHOSPHORUS COMPOUNDS. II: SYNTHESIS AND CHOLINESTERASE ACTIVITY OF THE ENANTIOMERS OF ISOPROPYL METHYLPHOSPHONOFLUORIDATE (SARIN) [STEREOSPECIFICITEIT VAN HYDROLYTISCHE ENZYMEN BIJ REAKTIE MET OPTISCH AKTIEVE ORGANISCHE FOSFORVERBINDINGEN. II: SYNTHESE EN CHOLINESTERASE-AKTIVITEIT VAN DE ENANTIOMEREN VAN ISOPROPYL METHYLFOSFONFLUORIDAAT (SARIN)]
H. L. Boter Sep. 1965 13 p refs *Its* Rept.-1965/12
(TDCK-43718) CFSTI: HC $1.00/MF $0.50

Ten years ago the presence of two stereoisomeric forms in sarin could be inferred from acetylcholinesterase inhibition experiments. Since that moment investigations have been carried out in various laboratories with the aim to isolate the enantiomers of sarin; however only negative results were obtained. After several fruitless experiments we succeeded in synthesizing both enantiomeric forms of sarin by the reaction of the sodium salts of +- and −-O-isopropyl methylphosphonothioic acid with 2, 4, 6-trinitrofluorobenzene, using acetone or methyl acetate as the solvent. The reaction proceeded with inversion of configuration, as could be established by a chemical method. Rotatory dispersion experiments and racemization experiments were carried out in undiluted form and in various solvents. Inhibition of acetylcholinesterase and butyrylcholinesterase by the enantiomers of sarin showed that −-sarin is more active than +-sarin. The ratio of activity of the optically pure forms will be at least 4000 for the first mentioned enzyme and approximately 2 for the second. Optical purities, determined by means of acetylcholinesterase inhibition, varied from 54–76%. Author

N66-15840# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seiberseorf (Austria).
^{99m}TECHNETIUM GENERATOR USING Fe_2O_3 AS SORBENT FOR ^{99}MOLYBDENUM
S. Bulbulian, B. Bauer, and H. Sorantin Jun. 1965 16 p refs Submitted for Publication
(SGAE-CH-18/1965) CFSTI: HC $1.00/MF $0.50

Carrier free ^{99m}Tc has been obtained using a generator, which was filled with Fe_2O_3 and then loaded with ^{99}Mo. Elutions were made with 0.1 N HNO_3 at different intervals of time getting a high specific activity of ^{99m}Tc. The overall yield was 55–70%. The results of laboratory and hospital scale tests are reported. Author

N66-15844# Rocket Power, Inc., Pasadena, Calif. Research Labs.
RESEARCH ON CHEMICAL SYNTHESIS WITH MONOENERGETIC IONS Final Technical Report, 1 Oct. 1960–30 Sep. 1964
C. Bodai, L. K. Branson, B. Chai, M. Farber, and N. G. Kim [1964] 19 p refs
(Contract AF 49(638)-913)
(AFOSR-65-1691; AD-624087) CFSTI: HC $1.00/MF $0.50

A new technique for the synthesis of chemical compounds was developed. Pure nitrobenzene was synthesized by bombarding the benzene molecule with a beam of NO_2^+ ions under carefully controlled conditions. Ortho, meta and para nitrotoluene were also prepared by the reaction of toluene with NO_2^+ ions. The apparatus used consists of an ion source capable of providing a low energy (1 electron volt) high-current (1 milliampere) beam of selected ionic species; an electrostatic potential control or accelerator for extracting the current from the source and giving accurate ion energies on the order of one electron volt; a reaction vessel in which the ions interact with the target molecules to produce a chemical reaction; and a cold trap to collect the products of reaction. Author (TAB)

N66-15849# Oxford Univ. (England). Inorganic Chemistry Lab.
THE REACTION OF ATOMS AND RADICALS WITH VARIOUS MOLECULES Final Report
J. W. Linnett Mar. 1965 73 p refs
(Grant AF-EOAR-63-32)
(AFOSR-65-1491; AD-623185) CFSTI: HC $3.00/MF $0.75

Some experiments were accomplished on the absorption of hydrogen atoms by palladium, and palladium-gold alloys. This work was carried out in connection with some earlier work on the catalytic effect of these metals and alloys on the recombination of hydrogen atoms. The attack of a number of metals by molecular and atomic oxygen was examined in order to discover in which cases there were considerable differences in rate. Experiments were also undertaken on the recombination of oxygen atoms on the surface of the alkali metal tungsten bronzes. A pressure gauge is described which was devised for the rapid and convenient measurement of pressures in mixtures containing chlorine at pressures of the order of 1 mm., the accuracy being about ± 0.01 mm. TAB

N66-15860# Naval Research Lab., Washington, D. C.
A METHOD FOR THE DETERMINATION OF STRONG-ACID VAPORS IN THE PPM RANGE Final Report
D. D. Williams, E. T. Johnson, and R. R. Miller 14 Oct. 1965 10 p
(NRL-6332; AD-624296) CFSTI: HC $1.00/MF $0.50

A nondiscriminating method for the quantitative detection of strong-acid vapors has been developed. The colors produced by passing known volumes of suspect air through disks of filter paper impregnated with an acid-sensitive reagent are compared with the colors on a calibrated reference chart. Reproducible sampling and analysis are accomplished in less than one minute with one to five strokes (100–500 cc) of a bellows-type hand pump. The range of the method as presently calibrated is 0.2 to 40.0 ppm by volume as monobasic gas. Author (TAB)

N66-15878# International Lab. of Genetics and Biophysics, Naples (Italy).
REPORT OF ACTIVITIES OF THE INTERNATIONAL LABORATORY OF GENETICS AND BIOPHYSICS, JULY 1, 1963–JUNE 30, 1964 Annual Progress Report
Brussels, EURATOM, Nov. 1965 52 p refs
(Contract EURATOM-012-61-12 BIAI)
(EUR-2589.e) CFSTI: HC $3.00/MF $0.50

The fields covered include genetics and biophysics of bacterial viruses; human, animal and biochemical genetics; the biochemistry of nucleic acids and of the nervous system; the radiobiology, genetics and physiology of mammalian cells in culture; and of oncogenic viruses. Author

N66-15903# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
AN X-RAY DIFFRACTION STUDY OF THE VARIATION OF THE LATTICE PARAMETERS AND THEIR RATIO FOR BERYLLIUM OXIDE AT TEMPERATURES UP TO 2000°C
P. J. Baldock, W. E. Spindler, and T. W. Baker Jul. 1965 13 p refs
(AERE-R-4471)

Accurate measurements of the variation of the lattice parameters of beryllium oxide with temperature have been obtained, using a high temperature X-ray diffractometer. These measurements show that the axial ratio decreases with rise in temperature. Author

N66-15913# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
A STUDY OF THE VAPOURISATION OF EUROPIUM DICARBIDE
R. H. Flowers Aug. 1965 14 p refs
(AERE-R-5012) HMSO: 1s 9d

A pure specimen of EuC_2 has been synthesized from the elements and its vaporization behaviour studied by means of precise Knudsen effusion measurements. The existence of a stable $EuC_{2.00}$ phase is confirmed and the equilibrium vapor, in the temperature range studied, is found to consist only of europium, presumably in monatomic form. The europium pressure follows the relation:

$$4.757 \log_{10} P\,(\text{atm}) = -\frac{87390}{T} + 27.4$$

from which the standard heat of formation of EuC_2 is estimated as

$$\Delta H^{\circ}_{298}(f) = -30.6 \text{ kcal/mole} \pm 4.5$$

As with other incongruent vaporization processes, the attainment of the equilibrium pressure is significantly affected by solid phase diffusion rates. Author

N66-15916# European Atomic Energy Community, Brussels (Belgium).
THE EFFECT OF VARYING THE ENVIRONMENTAL CALCIUM AND PHOSPHATE CONCENTRATIONS ON NUCLEAR DAMAGE IN X-IRRADIATED CULTURES OF BONE MARROW AND THYMUS
J. F. Whitfield, H. Brohee, and T. Youdale 1964 12 p refs
(EUR-2485.e) CFSTI: HC $1.00/MF $0.50

During the first 6 hours after irradiation (500 r) of suspension cultures of rat bone marrow, the nuclei of the various blast cells, promyelocytes, myelocytes, normoblasts and cells of the lymphocyte family lost their reticular nuclear structure and became structurally homogeneous. The rate of post-irradiation development of nuclear homogeneity was increased by lowering the calcium content and raising the inorganic phosphate concentration of the medium. The rate of appearance of nuclear homogeneity in irradiated thymocyte suspensions was affected in the same directions by altering the calcium and phosphate concentrations, but it was less sensitive than bone marrow to variations in the calcium level. The development of nuclear homogeneity in cells from unirradiated bone marrow cultures was unaffected by variation of the calcium content of the medium. Author

N66-15920# United Kingdom Atomic Energy Authority, Harwell (England). Library.
STUDY OF COMPLEX AND COVALENT IRON COMPOUNDS USING THE Fe^{57} MOSSBAUER EFFECT
Werner Kerler, Wolfgang Neuwirth, Ekkehard Fluck, Peter Kuhn, and Bodo Zimmermann Nov. 1964 36 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 173, no. 3 p 321–346
(AERE-TRANS-1026) CFSTI: HC $2.00/MF $0.50

A number of complex and covalent iron compounds in the oxidation states 0, +2, +3, +6 and with coordination numbers 4, 5, 6 has been investigated at different temperatures. A source of Co^{57} in Pd has been made, which was shown to be well suited for such measurements. The influence of the crystalline environment has been studied by putting iron complexes in different lattices. Ligands of iron complexes have been exchanged to look for influences of different bonds. It has been shown that measurements are also possible in frozen solutions and applications of this method are discussed. It has been found that in Prussian blue and Turnbull's blue there is no so-called electron exchange between the different Fe. The Curie point of $KFeS_2$ has been determined to be −28° C and it was possible to study the fields and line-shifts in its neighborhood. For some compounds indications of their structure and the sign of the electric field gradient could be derived from the data. The data are compiled in tables to allow further discussions from different points of view. Author

N66-15936# Pennsylvania State Univ., University Park. Dept. of Chemistry.
PHYSICAL PROPERTIES OF ISOTOPICALLY SUBSTITUTED MOLECULES Final Report
William A. Steele Aug. 1965 7 p refs
(Grant AF-AFOSR-118-63)
(AFOSR-65-1693; AD-624163) CFSTI: HC $1.00/MF $0.50

The research accomplishments of this study include: (1) completion of a balance for accurately measuring fluid density over wide ranges of temperature and pressure (2) construction

of a low temperature still for purifying materials whose densities were measured; and (3) measurement of the density of methane and perdeuteromethane at temperatures from the melting point to the critical region, and at pressures up to 80 atm. The balance attained an accuracy of 1–2 parts in 10,000 in density and of = 0.1 psi pressure and = 0.01 C temperature.

Author (TAB)

N66-15937# Naval Research Lab., Washington, D. C.

POTENTIAL OF A PLATINUM ELECTRODE AT LOW PARTIAL PRESSURES OF HYDROGEN OR OXYGEN

T. B. Warner and S. Schuldiner 15 Apr. 1965 13 p refs (NRL-6244; AD-624024) CFSTI: HC $1.00/MF $0.50

The open-circuit potential on bright platinum in 1M H_2SO_4 was studied as a function of oxygen or hydrogen partial pressure from .10 to 10^{-7} atm. The very low rates of H_2 or O_2 flow which were required were produced by a special gas generator. Potentials predicted by the Nernst equation for the H^+/H_2 couple were not observed below .0010 atm H_2 partial pressure. A Nernst relation with a slope of 0.06 v per decade of O_2 partial pressure was found. The O_2 leak into the closed system used was found to be about 10^{-7} atm. Based on the assumption that dissolved O_2 decreases the effective H_2 partial pressure at the electrode surface, an equation was developed for obtaining the effective H_2 partial pressure. Author (TAB)

N66-15939# Tufts Univ., Medford, Mass. Dept. of Chemistry.

DIELECTRIC DISPERSION Summary Report, Oct. 1, 1964–Sep. 30, 1965

Karl B. Illinger [1965] 4 p refs

(Contract Nonr-494(19))

(QSR-17; AD-622704) CFSTI: HC $1.00/MF $0.50

With the prototype broadband microwave spectrometer, covering in a continuous manner the frequency range between 8.2 and 40 kmc (0.75 to 3.66 cm wavelength), constructed earlier under this contract, as a starting point, salient modifications have recently been made which increase the sensitivity and stability of the existing system. Frequency stabilization of the microwave oscillator, capability of direct frequency measurement to electronic counter accuracy, power leveling and phase-sensitive detection have been incorporated. A design for a broadband spectrometer operating in the range between 50 and 75 kmc (0.4 to 0.6 cm), and extension of this capability to the harmonic range (0.2 to 0.3 cm) has been completed; frequency stabilization of these systems is accomplished by injection phase-locking from the stable 8.2 to 40 kmc referred to above. Author (TAB)

N66-15964# Portugal. Nuclear Energy Commission, Sacavem. Chemical and Metallurgy Div.

CHANGES IN THE FORMATION OF H_2O_2 IN SOLUTIONS OF SULFURIC ACID IRRADIATED WITH α PARTICLES OF 5.3 MeV [RENDIMENTOS DE FORMACAO DE H_2O_2 NA IRRADIACAO DE SOLUCOES DE ACIDO SULFURICO COM PARTICULAS α 5,3 MeV]

Maria Helena Mariano 1964 17 p refs In PORTUGUESE; FRENCH Summary Presented at the 27th Cong. Luso-Espanhol Para o Progresso das Ciencias, Bilbao, Portugal, 20–24 Jul. 1964

(LFEN. 27 (α)) CFSTI: HC $1.00/MF $0.50

Measurements of the formation of H_2O_2 in 5×10^{-3} molar H_2SO_4 were made at atmospheric equilibrium after irradiation with 5.3 MeV alpha particles from Po^{210}. The dosage ranged from 0.28×10^{18} to 1.38×10^{18} eV/cc. It was found that for sulfuric acid concentration less than 5×10^{-2} molar, $G(H_2O_2)$ increased linearly with $(HSO_4^-)^{1/3}$. In the interval between 5×10^{-2} and 10^{-1} molar H_2SO_4, $G(H_2O_2)$ remained constant. For concentrations greater than 10^{-1} molar, the yield was a linear decreasing function of the 1/3 power of the HSO_4 concentration. The results are interpreted as indicative of the interference of sulfuric acid in the mechanism of radiolysis of water. Transl. by B.G.

N66-15989*# Westinghouse Electric Corp. Baltimore, Md. Aerospace Div.

TEOS OXIDE STUDIES Final Project Report, 15 Feb.–15 Aug. 1965

R. M. Mc Louski [1965] 73 p refs

(Contract NAS5-3758)

(NASA-CR-69681) CSCL 07A CFSTI: HC $3.00/MF $0.75

This report is based on experiments on the chemical decomposition of silica films on silicon substrates at temperatures less than 700° C., and the use of doped silica films as diffusion sources when formed by the addition of trace amounts of gaseous dopants under optimum growth condition of the silica films. The silica films were formed by the decomposition of tetraethyl orthosilicate (TEOS) in an oxygen atmosphere. Simultaneous decomposition of TEOS and trace amounts of B_2H_6, PH_3 and AsH_3 were used to form the doped silica films. The data is presented in both tabular and graphical form, and the deposition system employed is described. Analysis of the data indicates that the undoped silica films formed by the pyrolysis techniques described were comparable to the films formed by thermal methods of oxide growth. The doped silica films containing boron, phosphorus, or arsenic were used successfully as diffusion sources. It was possible to control the sheet resistivities of an arsenic diffusion over a wider range than that of boron or phosphorus when these films are employed as diffusion sources. Author

N66-15990*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.

EPITAXIAL PROCESS DEVELOPMENT FOR MONOLITHIC COMPLEMENTARY MOS-FET STRUCTURES WITH P-N JUNCTION ISOLATION Final Report, 1 Feb.–15 Jul. 1965

G. W. Skouson [1965] 29 p refs

(Contract NAS5-3758)

(NASA-CR-69682) CSCL 07A CFSTI: HC $2.00/MF $0.50

This report summarizes the work done on and the results of the p-type silicon back filling of grooves or pockets etched into n-type silicon slices. Two methods of etching pockets are discussed, gaseous high temperature and the wet chemical method. Comparisons are noted of each. A process is provided along with specifications and directions whereby these results may be evaluated and/or duplicated. Photos and diagrams show general usefulness of the methods discussed.

Author

N66-15991# IIT Research Inst., Chicago, Ill.

A FEASIBILITY STUDY TO INCREASE THE ACTIVITY OF OXIDES WITH OXYGEN AND TO LOWER THE IGNITION TEMPERATURE OF SLURRY METALS Quarterly Progress Report, 1 Apr.–31 Oct. 1965

Eli S. Freeman, Winifried Rudloff, and Aaron V. Becker 9 Nov. 1965 29 p refs

(Contract AF 33(615)-2688)

(IITRI-U6020-6; AD-624540) CFSTI: HC $2.00/MF $0.50

The influence of doping on the reactivity of cobalt oxides was investigated by DTA and TGA (thermogravimetric analysis). Particularly, the influence of anionic impurities such as fluorides was studied. Additional doping procedures were also explored. Samples were vacuum-coated under potassium vapor. It is

found that this procedure reduces the cobalt oxide, Co_3O_4, almost completely to metallic cobalt. Doping with fluorides, especially with PbF_2, has the effect of shifting the exothermal oxidation peaks by as much as 60° C. Investigations of the system Pd, PdO lead to the conclusion that the oxidation of pure Pd is primarily a surface reaction as indicated by only a 1% weight change during repeated decomposition-oxidation cycles. Doping with fluorides, particularly with Na_2SiF_6 resulted in a 10-fold increase in the reaction rate as indicated by a pronounced increase in exothermal and endothermal DTA band areas. Author (TAB)

N66-16023# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
^{60}CO-GAMMA RAYS INDUCED CARBOXYLATION OF METHYLAMINE
L. R. de la Paz and N. Getoff 1965 19 p refs
(SGAE-CH-21/1965) CFSTI: HC $1.00/MF $0.50

The carboxylation of methylamine in aqueous solutions containing CO_2, bicarbonate or carbonate was studied as a function of radiation dose, pH-value and of the concentration of methylamine. Besides glycine, the main carboxylation product, some other amino acids, such as proline, alanine and small amounts of α-γ-amino butyric acid, were formed. The initial G-value of glycine increases from 0.24 at pH = 3 to 0.8 at pH = 9 and drops to 0.2 at pH = 12. To distinguish between the amino acids and the other products formed, $^{14}CO_2$ was used as radio indicator. Probable reaction mechanisms are proposed for the explanation of the experimental results. Author

N66-16035# Air Force Cambridge Research Labs., Bedford, Mass.
SPECTRA OF ANIONS: ACETYLACETONATES
Carl A. Pitha [1965] 35 p
(AD-620843) CFSTI: HC $2.00/MF $0.50

An investigation was undertaken to establish whether the electronic states of an anion are influenced by an associated metal ion, and if they are, under what conditions. An investigation of the ultraviolet absorption spectra of more than 40 metal acetylacetonates in iso-octane solution reveals that only certain metal ions influence the electronic states of metal acetylacetonates, and that the critical characteristic of the metal ion is its polarizing ability as reflected in Z/r. Water as a solvent, contaminant, or component of the acetylacetonate, as in hydrates, destroys this interaction. Other metal ion characteristics which appear as significant variables are the presence or absence of d-orbital electrons, valence, magnetic state, and the molecular geometry. The perturbing influence of 'reactive' solvents, such as the alcohols, is sufficiently great to obliterate most, if not all relationships. Author (TAB)

N66-16147*# National Aeronautics and Space Administration, Washington, D. C.
ISOTOPIC EXCHANGE OF OXYGEN ON SILVER FILMS [IZOTOPNYY OBMEN KISLORODA NA PLENKAKH SEREBRA]
G. K. Boreskov, A. V. Khasin, and T. S. Starostina Jan. 1966 14 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 164, no. 3, 1965 p 606-609 refs
(NASA-TT-F-9856) CFSTI: HC $1.00/MF $0.50 CSCL 07B

The oxygen bond on the surface of silver is analyzed by studying the isotopic exchange of adsorbed oxygen with gaseous oxygen, and also by investigating homomolecular exchange of oxygen. The adsorption kinetics were studied on silver films condensed at room temperature and at −195°. Tables are given for exchange rates in both reactions. It is found that the adsorption-desorption mechanism is responsible for both types of exchange. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N66-15202*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEMS OF SPACE RADIO COMMUNICATION
N. T. Petrovich and Ye. F. Kamnev Jan. 1966 282 p refs Transl. into ENGLISH of the book "Voprosy Kosmicheskoy Radiosvyazi". Moscow, Izd-vo Sovetskoye Radio, 1965
(NASA-TT-F-366) CFSTI: HC $6.00/MF $1.50 CSCL 17B

This book considers the use of artificial Earth satellites and the Moon for the creation of global and local ground communication systems and the provision of two-way radio communication between the Earth and spacecraft. The general principles of the design of communication systems using satellite relay are presented, and examples are given of global and local ground communication systems. On the basis of the analysis of the quantities appearing in the active and passive communication equations, an evaluation is made of the optimal operating frequencies and the power requirements for active and passive relay. A power requirement analysis is made for space radio communication links within the limits of the solar system. A review is presented of the published data on systems for spacecraft communication issued in the USSR and USA, as well as data on satellite communication systems. Author

N66-15299 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REFLECTION OF ELECTROMAGNETIC WAVES FROM THE OPEN END OF A WAVEGUIDE
S. S. Kalmykova *In its* Ukrain. J. of Phys. 30 Sep. 1965 7 p refs (See N66-15298 06-23) CFSTI: HC $1.00/MF $0.50

An examination is made of an anisotropic cylinder ($r \leq a$, $-\infty < z < \infty$) whose properties are described by piecewise continuous functions. It is assumed that a surface wave can be propagated along the right ($z > 0$) portion of the waveguide, and fields are found which are generated as a result of scattering of this wave. Using the Maxwell equations, solutions are derived for cases when a superconducting diaphragm ($z = 0$, $r \leq a$) is placed between the waveguides and for the problem of reflection of a surface wave from the open end of a thin plasma waveguide. C.T.C.

N66-15603# Illinois Univ., Urbana. Radiolocation Research Lab.
IMPEDANCE MEASUREMENTS MADE ON A 600-OHM MULTIPLE-WIRE DELTA ANTENNA Technical Note No. 3

Fred R. Ore Aug. 1965 16 p ref *Its* Antenna Lab. Rept.-65-19
(Contract NObsr-89229)
(RRL-285; AD-623357) CFSTI: HC $1.00/MF $0.50

The impedance of this antenna system remains acceptable over the frequency range of 1 to 32 Mc. The input VSWR is less than 2.3 over this frequency range. The marginal impedance occurs at a frequency of approximately 22 Mc.
Author (TAB)

N66-15652# Syracuse Univ. Research Inst., N. Y. Dept. of Electrical Engineering.
A BEAM-SHIFTING TECHNIQUE FOR SIDE LOBE REDUCTION AND PATTERN SYNTHESIS
José Perini Griffiss AFB, N. Y., RADC, Nov. 1965 42 p refs
(Contract AF 30(602)-2646)
(EE957-6509T13; RADC-TR-65-381; AD-624605) CFSTI: HC $2.00/MF $0.50

The idea of this method is to produce a narrow beam by using an aperture of convenient size with uniform illumination. By progressively phasing the aperture illumination this beam is shifted. Many beams are superposed and usually shifted in such a way that the maximum of each coincides with the zeros of all the others. By controlling the maximum amplitude of each beam, sidelobe reduction or pattern synthesis can be accomplished. Several examples are given. The results are indistinguishable from those of more involved methods. The method is extremely simple and gives a good feeling of the influence of each parameter in the resulting pattern. This is a very important feature because it makes possible an easy determination of the changes necessary to improve a synthesized pattern. This is illustrated in some of the examples. The method applies to discrete arrays as well as to continuously illuminated apertures.
Author (TAB)

N66-15658# Northrop Corp., Hawthorne, Calif. Norair Div.
A SOURCE DISTRIBUTION TECHNIQUE FOR THE SOLUTION OF GENERAL ELECTROMAGNETIC SCATTERING PROBLEMS Phase 1 Report
Fred K. Oshiro and Charles W. Su 13 Oct. 1965 67 p refs
(Contract AF 33(615)-3166)
(NOR-65-271; AD-624586) CFSTI: HC $3.00/MF $0.75

The source distribution technique (SDT) embodies a comparatively simple and unrestricted computational method applicable to the complex problem of scattering from arbitrarily shaped geometries. The procedure exhibits a greater degree of flexibility and accuracy than present day approximation techniques. It is a numerical procedure for determination of the radar cross section for complex targets, based on an integral equation approach. It can be employed to determine the electromagnetic scattering from arbitrarily shaped two- and three-dimensional geometries in the difficult resonant frequency ranges in which classical solutions are not available. Combined with the Norair Physical Optics procedure the 'SDT' can be employed to determine the electromagnetic scattering of a variety of shapes, including large scattering objects; i.e. >2 lambda. Verification of the technique was performed on the Norair radar reflectivity range. An image-plane was utilized to measure the current distribution and scattered fields. A brief outline of the basic procedure is described together with a few examples to demonstrate its validity.
Author (TAB)

N66-15662# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
SHF SEQUENTIAL LOBING SYSTEM
Peter Koert, Robert M. Ruttenberg, and Roy L. Rogers 28 May 1965 39 p refs
(Contract DA-36-039-AMC-03404(E))
(EDL-M788; AD-624304) CFSTI: HC $2.00/MF $0.50

This report describes the characteristics of a broad-band sequential-lobing array and the performance of a beam-forming network designed for a SHF (1 to 11 Gc) tracking system. Tracking is accomplished by comparing the signals received from beams directed off the boresight axis. The beams are formed by sequentially alternating the phase between four lens-corrected double-ridged horns in a four-horn array.
Author (TAB)

N66-15663# Ewen Knight Corp., East Natick, Mass.
MOLECULAR ATMOSPHERIC OXYGEN HORIZON STUDY. DATA EVALUATION STUDY REPORT Scientific Report No. 3
Hugh P. Taylor 5 Oct. 1965 66 p refs
(Contract AF 19(628)-3239)
(AFCRL-65-820; AD-624615) CFSTI: HC $3.00/MF $0.75

Since many attitude controlled earth satellites have been oriented in the direction of the instantaneous local vertical, the accurate determination of the spacecraft's instantaneous local vertical is a major problem of concern. The solution previously proposed is to utilize the thermal radiation from oxygen in the earth's atmosphere to establish the local vertical at the space vehicle. The oxygen radiation, which appears to be well defined, presents a most attractive means of establishing the local vertical, independent of the spatial distribution of weather and temperature variations appearing across the surface of the earth. This report is concerned with the utilization and interpretation of data taken with a prototype radiometer. The objective is to arrive at a quantitative conclusion with respect to the efficacy of a microwave vertical sensing configuration. Restrictions on the data and their effect on the conclusion to be drawn due to satellite environment considerations are discussed. The radiometer design is reviewed and the telemetry requirements indicated.
TAB

N66-15717# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE MEASUREMENT OF PHASE AND AMPLITUDE RADIO WAVE INTERACTION AT UNIVERSITY PARK, PENNSYLVANIA FOR APRIL–MAY–JUNE, 1965
Anthony J. Ferraro and Hai Sup Lee 15 Aug. 1965 46 p refs
Its Sci. Rept.-250
(Contract AF 19(628)-4014; Grant NSF GP-846)
(AFCRL-65-778; AD-624393) CFSTI: HC $2.00/MF $0.50

The objective of the present work is to study the properties of ionospheric D-region using radio wave interaction effect which is also commonly known as Luxembourg effect. The present technique closely follows that developed by Fejer (J. Atmosph. Terr. Phys. 7,322)(1955) for radio wave amplitude interaction experiment. However, the technique of measurement as well as the theory of radio wave interaction have been extended and generalized at the Ionosphere Research Laboratory by the introduction of complex coefficient of interaction T, to embody the effect of interaction on both the amplitude and the phase of radio waves.
TAB

N66-15719# Sylvania Electric Products, Inc. Williamsville, N. Y.
ELECTRONICALLY STEERABLE ARRAY—CHANGE A Second Quarterly Technical Report

T. R. Schiller, P. F. Weiss, and W. S. Heath Griffiss AFB, N. Y., RADC, Nov. 1965 70 p refs
(Contract AF 30(602)-3041)
(RADC-TR-65-228; AD-624791) CFSTI: HC $3.00/MF $0.75

The report describes the effort expended during the second quarter on the engineering change 'A' portion of the electronically steerable array program to design and build a high gain, electronically steerable, millimeter antenna system. During this period, design concepts for the breadboard model antenna system were formulated, methods for two-dimensional scanning were investigated, both theoretically and experimentally, and hexagonal ferrite samples were evaluated with respect to their application in scanning millimeter beams. Construction also started on a dual-element ferrite scanner array which will be used in further tests to determine the feasibility of using such scanners as array elements. Author (TAB)

N66-15748# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON ELECTRO-TECHNOLOGY [ELECTRO-TECHNIEK LITERATUUROVERZICHT]
21 Oct. 1965 37 p In ENGLISH, DUTCH, FRENCH, and GERMAN *Its* Vol. 14, No. E-473 CFSTI: HC $2.00/MF $0.50

Telecommunications, electronics, radar, information processing, and computer systems are the general areas covered in a literature survey. Abstracts deal with analog computers, computer hardware and applications, and measuring and regulating techniques. Other topics reviewed include oscillators and magnifiers, filters and networks, and electromagnetic radiation. M.W.R.

N66-15852# National Bureau of Standards, Boulder, Colo.
FIELD STRENGTH MEASUREMENTS—PHASE II Technical Report No. 3, 1 Mar. 1963–1 Jun. 1964
A. C. Stewart Griffiss AFB, N. Y., RADC, Oct. 1965 45 p refs
(Contract AF 30(602)-2936)
(RADC-TR-65-279; AD-624550) CFSTI: HC $2.00/MF $0.50

The measurement of the strength of radio frequency fields at high frequency and above has followed practices which are standard for the measurement of field strength at medium and low frequencies. Variability of measurements made in practical situations and a lack of reproducibility of measurements made under apparently identical conditions has prompted an investigation of equipment and methods used in the determinations. The field strength measurement study was undertaken to understand the nature of the problem and to develop techniques for more accurate determinations of field strength and more significant interpretation of measured data. A Stoddart Aircraft Company NM-52A field strength meter which has a frequency range of 375 to 1000 MHz was calibrated and evaluated using conventional methods. Instrumentation to extend the upper frequency limit of the testing procedure from 10 to 20 GHz was procured. Field strength meter antennas in the 2 to 4 GHz frequency range were tested and comparisons made with similar tests conducted by RADC. Methods of simplification of data acquisition and processing for use in aperture synthesis were investigated.
Author (TAB)

N66-15864# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrophysics.
INVESTIGATIONS ON THE GUIDING, SCATTERING, AND RADIATION OF ELECTROMAGNETIC WAVES Final Report, Dec. 1, 1960–Dec. 31, 1964
Arthur A. Oliner 2 Jul. 1965 143 p refs
(Contract AF 19(604)-7499)
(PIBMRI-1272-65; AFCRL-65-537; AD-624843) CFSTI HC $4.00/MF $1.00

Contents: General studies of wave types at an interface; Guiding and scattering by sinusoidally-modulated dielectric structures; Radiation from periodically modulated slow-wave structures; Scattering resonances on periodic structures; Consequences of symmetries in periodic structures; Parametric interactions of waves in space-time periodic structures; Waveguide discontinuity studies; Comprehensive notes on modal analysis and synthesis. TAB

N66-15904# Library of Congress, Washington, D. C. Aerospace Technology Div.
RE-ENTRY COMMUNICATIONS STUDIES Surveys of Soviet Scientific and Technical Literature
George Steblez 10 Sep. 1965 57 p refs Compilation of abstracts
(ATD-P-65-73; AD-622194) CFSTI: HC $3.00/MF $0.50

Abstracts are given for re-entry communication studies for the years 1960 through 1964, published in Soviet open-source literature. TAB

N66-15927# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrophysics.
ELECTRIC FIELD PATTERNS IN A FERRITE LOADED WAVEGUIDE
Pietro de Santis [1965] 45 p refs
(Contract AF 49(638)-1402)
(PIBMRI-1281-65; AD-624077) CFSTI: HC $2.00/MF $0.50

A rectangular waveguide loaded with a transversely magnetized ferrite slab is analyzed. The diagram, longitudinal propagation constant vs. distance of the ferrite slab from the side wall, is studied to get some information on the electric field patterns in the cross section of the guide. A numerical case of interest is studied with parameters having values between those used by Barzilai and Gerosa and those by Lax and Button. Author (TAB)

N66-15934# Ohio State Univ. Research Foundation, Columbus.
EFFICIENT RECURSIVE SOLUTIONS FOR PLANE AND CYLINDRICAL MULTILAYERS
J. H. Richmond 10 Aug. 1965 27 p ref
(Contract NOw-65-0329-d)
(Rept.-1968-1; AD-624191) CFSTI: HC $2.00/MF $0.50

An efficient recursive solution is developed for the transmission and reflection coefficients of a plane multilayer and for the scattering pattern of a cylindrical multilayer. The two principal polarizations are considered, and digital-computer programs are included. The technique is also applicable to the multilayered sphere. The appropriate equations are also given for the reflection coefficients of a perfectly conducting plane which is coated with a stack of homogeneous dielectric sheets, and for the scattering pattern of a perfectly conducting circular cylinder coated with several homogeneous dielectric layers. Author (TAB)

N66-15945# Columbia Univ., New York. Electronics Research Labs.
ELECTRO-OPTICAL SIGNAL PROCESSING TECHNIQUES FOR PHASED ARRAY ANTENNAS Quarterly Progress Report P-3/321, Apr. 1–Jun. 30, 1965
L. Lambert 1 Jul. 1965 63 p refs
(Contract AF 49(638)-1478; ARPA Order 279)
(CU-13-AF-1478-ERL; AD-624132) CFSTI: HC $3.00/MF $0.75

The research program for the development of electrooptical signal processing techniques applicable to phased array antenna systems is continued. A brief analysis of the planar array processor formed by combining the 'spatially multiplexed' and 'time-delay multiplexed' linear array processor techniques is presented. A description of the experimental system and the results obtained when processing signals simulating the output from a uniformly weighted planar array of 576 elements is included. The output response is very nearly ideal for signals on and off the boresight axis. The experimental results obtained with a spatial filter system at the laser output beam, and the frequency response of the multiple transducer are included. The theory and techniques developed for aperture weighting in the time-delay multiplex signal simulator are discussed. Author (TAB)

N66-16027# Cosmic, Inc., Washington, D. C.
RADAR SCATTERING FROM SATELLITE WAKES Final Report
John J. Shea Griffiss AFB, N. Y., RADC, Oct. 1965 44 p refs
(Contract AF 30(602)-3678)
(RADC-TR-65-283; AD-624440) CFSTI: HC $2.00/MF $0.50

A satellite traversing its ionized ambient surroundings possesses an elongated wake. The objective of the effort reported has been to verify that this wake region has a radar cross-section large compared to the geometrical cross-section of the satellite itself. A detailed method is established for this calculation, and by carrying out the calculation for representative conditions, the enhancement is shown possible. Author

N66-16030# Naval Oceanographic Office, Washington, D. C.
DATA ON THE USE OF SECTOR RADIO-RANGE BEACONS AND THE CHARACTERISTICS OF OPERATION [EKSPLUATATSIONNYYE DANNYYE SEKTORNYKH RADIOMAYAKOV IS OSOBENNOSTI RABOTY]
Ye. Ya. Shchegolev 1965 26 p Transl. into ENGLISH from the book "Radiotekni Cheskiye Sredstva Morskogo Sudovozhdeniya" Moscow, 1956 p 293–313
(TRANS-247; AD-624200) CFSTI: HC $2.00/MF $0.50

The characteristics of electromagnetic field in the area near the radio-range beacon are analysed, pointing out the audibility zones. Thus the degree of accuracy in determining the bearings of the beacons is increased. A comparison among various radio-range beacons (Stavanger, Ploneis, Bushmills) shows the variations of accuracy when determining a ship's location in various sectors and the means of improving the accuracy. The development of the improved consolan type of sector radio-range beacons, which was discussed at the International conference on ocean navigation in 1954–1955, is also outlined. Author (TAB)

N66-16044# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
DATA TRANSFER EXPERIMENTATION FOR CONUS Interim Report
William F. Sullivan Dec. 1965 54 p
(RD-65-110)

Tests were conducted using the Model A traffic control simulator to explore the use of digital high speed communications in the air traffic control environment. Simulated input and output devices were provided for use by the controllers working at an en route position so that the controllers were able to select, compose, and transmit traffic control messages to the simulator pilots by other than the usual voice methods. The results indicated that there are eight major categories of messages that are suitable for ground-to-air transmission using digital methods in lieu of voice. Three of these categories (altitude, frequency, and heading change instructions) require quick-action input keys for the controller and should be displayed to the pilotature 4-digit indicator in the cockpit. Such control instructions require priority handling and therefore need instantaneous pilot acknowledgement by voice. The other five categories involve clear text messages that should be displayed to the pilot on a cockpit printer. They are selected from computer storage and have a lower priority than the altitude and heading change instructions. Author

N66-16053*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SIGNIFICANT ELECTRONIC APPLICATIONS AND EXPERIMENTAL RESULTS FROM PROJECT ECHO
H. L. Eaker et al Nov. 1965 102 p refs Presented at WESCON/65, San Francisco, 24–27 Aug. 1965
(NASA-TM-X-55365; X-733-65-448) CFSTI: HC $4.00/MF $0.75 CSCL 17B

Development, testing, instrumentation, and communication experiments are reported for the Echo II project. Consideration is given to implementation, full scale ground tests of prototype spheres, the television system, the application of a beacon telemetry system for measuring orbital performance, and results of communication experiments. Ground inflation tests were made to evaluate the structural and rf backscatter characteristics of spheres as a function of their internal pressure. The television system is described which was used for obtaining pictures of the spacecraft operation including deployment, inflation, and injection into orbit. Also described is the beacon telemetry system used for tracking the satellite during orbit. The communication experiments include measurement of the signal level, coherent bandwidth tests, facsimile transmission tests, and voice and music transmission tests. C.T.C.

N66-16070*# Chrysler Corp., Huntsville, Ala.
SATURN ANTENNA SYSTEMS, SA-5, VOLUME 3
18 Jun. 1963 283 p Suppl. to "Checkout Procedures for SA-5 RF Systems Publications"
(Contract NAS8-4016)
(NASA-CR-69697) CSCL 17B

These supplementary checkout procedures for the Saturn SA-5 antenna system cover the altimeter antenna, Azusa antenna, C-band radar antenna, and Mistram antenna system. Descriptions and specifications of the antenna systems contain dimensional sketches, locational views, radiation patterns, trajectory geometries, contour plots, gain determinations, block diagrams, and the pertinent checkout procedures. G.G.

N66-16092*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
RADAR CROSS SECTION AND OPTICAL RADIATION FROM THE TRAILBLAZER IIa 9° HALF-ANGLE BLUNT NOSE CONE DURING HYPERSONIC REENTRY
Wayne L. Darnell Washington, NASA, Feb. 1966 88 p refs
(NASA-TN-D-3214) CFSTI: HC $3.00/MF $0.50 CSCL 17I

Data reduced from two radar and three optical radiation measurements made on a nose-cone configuration during a reentry test are presented and discussed. Brief theoretical explanations of the reasons for radar enhancement and optical radiation during reentry are included. The body, a 9° half-angle cone with a 12.32-inch-diameter spherical nose and 19.17-inch-diameter base, was reentered by the Trailblazer IIa vehicle and

provided test data from an altitude of about 219 500 feet to 71 000 feet and a velocity range of 19 700 fps to 10 000 fps. UHF and S-band radar provided the cross section and trajectory information. Comparison of the radar-cross-section and optical-magnitude curves showed that the radar enhancements occurred earlier than the optical radiation peaks. The radar-signal enhancements and optical radiations recorded for the reentry were reasonably substantiated by theory and compared well with other flights using similar body shapes and flight parameters. Author

N66-16099# Federal Communications Commission, Washington, D. C. Research Div.
ELEVATION AND DEPRESSION ANGLE TABLES
Elton Davis and Phil Tremper 15 Sep. 1964 113 p ref (R-6410; PB166890)

Sets of tables supplying elevation and depression angles for distances up to 150 miles and elevation differences up to plus or minus 5000 ft for use in radio propagation studies, are presented. The Fortran program, and the derivation of the formula used in calculating the tables are given. A smaller table of the same type has already demonstrated its usefulness in studying measurements of radio signals propagated over terrain having various roughness characteristics. L.S.

N66-16140*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADAR TRACKING SHIP PERFORMANCE DURING MA-8
Edward A. Ross 30 Oct. 1962 50 p
(NASA-TM-X-55357; X-551-62-198) CFSTI: HC $2.00/MF $0.50 CSCL 17I

Results are presented of support provided by the USAS American Mariner (DAMP ship), the USNS Watertown, and the USNS Huntsville for the Mercury MA-8 mission. Discussions are presented on the background of ship selection, preparation for support, and the actual results of the support. Consideration is given to such areas as the establishment of communications and data lines, training personnel in Mercury procedures, and data analyses. Equipment modifications and various graphs of tracking data are appended. C.T.C.

N66-16141*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADAR TRACKING SHIP PERFORMANCE DURING MA-9
Edward A. Ross, Jerome Barsky, and William C. Bryant 31 Jul. 1963 69 p
(NASA-TM-X-55358; X-554-63-161) CFSTI: HC $3.00/MF $0.75 CSCL 17I

The support provided by two radar tracking ships during the Faith-7 Mercury–Atlas mission (MA-9) was evaluated to determine the capabilities of existing vessels for the advanced Gemini and Apollo missions. The vessels had near state-of-the-art tracking, stabilization, and navigation systems, but lacked the required computer capability. Details are given on the location, premission validation of the electronic systems, indicated accuracy, data system and communication line checks and the testing enroute to site and mission support. The radar data obtained for each orbit are analyzed, and it was concluded that both ships performed well with the equipments at their disposal. However, it was pointed out, that the requirements of manned space flight impose several conditions which neither ship could completely meet. These are identified as onboard computer capability to generate acquisition points, reacquisition information, and scan patterns; a systematic procedure for validating component and system performance; periodic home port checks of alignment and total system accuracy, standardized test procedures; and accurate positioning. M.G.J.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N66-15206# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
CYCLOPS-2: A COMPUTER SYSTEM THAT LEARNS TO SEE Technical Report, 1 Jul. 1964–13 Oct. 1965
Burton H. Bloom and Thomas Marill [1965] 68 p refs
(Contract AF 19(628)-4306)
(TR65-RDI-1; AFCRL-65-731; AD-624152) CFSTI: HC $3.00/MF $0.75

The design of the Cyclops-2 System is discussed in detail. When completed, the system will have the ability to recognize visual shapes composed of arbitrary lines, to analyze scenes composed of arbitrary lines, to analyze scenes composed of such shapes, and to learn, i.e., to improve its own performance by examining correctly labeled examples. The techniques embedded in the design are quite general and can be applied to other recognition or learning situations than those Cyclops-2 was specifically designed to handle. Author (TAB)

N66-15271 Joint Publications Research Service, Washington, D. C.
COMPUTERS GIVE THE ANSWER
N. M. Potiyevskiy *In its* News of Soviet Cybernetics 29 Dec. 1965 p 1–3 (See N66-15270 06-34) CFSTI: $1.00

A brief discussion on improving the effectiveness of applying electronic computers to solving technical problems in Soviet Russia is presented. Inadequate training of personnel and improper application of computers to the specific task to be performed are among the problems discussed. M.R.W.

N66-15327# Michigan Univ., Ann Arbor. Communication Sciences Program.
TAPE MACHINE REALIZATIONS OF COMMUTATIVE REGULAR EVENTS
Richard Laing Sep. 1965 75 p *Its* Rept.-07363, 03105-39-T
(Contract Nonr-1224(21); Grant DA-ARO(D)-31-124-G665)
(AROD-4049-15; AD-623001) CFSTI: HC $3.00/MF $0.75

Infinite tape machine realizations of classes of commutative-regular events are explored. In particular, a class of events which requires for machine realization an infinite-state machine with an infinite number of final states, and a class, somewhat more intractable, which requires an infinite state machine with an infinite number of final states, and which in addition is not strongly connected, are considered. Procedures for constructing deterministic machines with infinite counter tapes, which realize the events under examination are given. Author (TAB)

N66-15367*# Stanford Univ., Calif. Microwave Lab.
A COMPUTER PROGRAM FOR ELECTRON OR ION GUN ANALYSIS: OPERATIONS MANUAL Interim Report

V. Hamza Sep. 1965 113 p refs
(Contract NAS3-4100)
(NASA-CR-54738; ML-1369) CFSTI: HC $4.00/MF $0.75
CSCL 09B

A computer program written in the IBM 7090 Fortran II programming language is described which is used to analyze the space charge flow in an electron or ion gun. It determines the nature of a beam profile for practically any specified two-dimensional or axially symmetric gun electrode system. The process followed assumes that the space charge density is zero, solves LaPlace's equation by finite difference methods, and finds the potential variation in the region of interest. With a knowledge of this potential variation, the motion of charge particles from the emitter source is determined, and the current density emitted is found by the Child–Langmuir law in the neighborhood of the emitter. The process is repeated through several iterative cycles, solving Poisson's equation instead of LaPlace's equation, until the final solution converges to a self-consistent solution. The program is illustrated by an example of an ion propulsion gun design. Subroutines of the computer program are listed with a brief explanation of their function.
R.N.A.

N66-15407# Stevens Inst. of Tech., Hoboken, N. J. Davidson Lab.
PRECOR, A KINGSTON FORTRAN II SUBROUTINE FOR SOLVING SETS OF ORDINARY DIFFERENTIAL EQUATIONS BY A PREDICTOR-CORRECTOR TECHNIQUE
Paul H. Rank, Jr. Jun. 1965 26 p refs
(Contract Nonr-263(36))
(TM-142; AD-470183)

A fourth-order stable predictor-corrector technique is used to solve certain differential equations. Author (TAB)

N66-15569# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
A PROGRAM TO RELOCATE AND PACK PROGRAMS IN BINARY FORMAT
J. W. Bowman Nov. 1965 20 p
(AECL-2508) CFSTI: HC $1.00/MF $0.50

A relocation package has been written to provide a means to shuffle machine language programs around in memory to make the most efficient use of computer store. This report describes this relocation program, the format required to make it possible and the operation of the program itself. The program is now in use and has proved to be a most effective tool, both in assembling a combination of existing programs, and in amending and fault finding new programs. Author

N66-15703# Stanford Research Inst., Menlo Park, Calif.
NOTES ON CLASSIFICATION CAPACITIES
T. Cover Griffiss AFB, N. Y., RADC, Oct. 1965 26 p refs
(Contract AF 30(602)-3448)
(RADC-TR-65-263; AD-624437) CFSTI: HC $2.00/MF $0.50

This is a working paper concerned with the problem of determining the information storage capacities of networks of linear threshold devices. Capacities of single element networks and low dimensional multielement networks are found, and bounds on capacities are discussed for general networks.
Author (TAB)

N66-15725# International Business Machines Corp., Yorktown Heights, N. Y.
STUDIES IN AUTOMATIC LANGUAGE PROCESSING Final Report, Mar. 1964–Jun. 1965
David Lieberman Jul. 1965 110 p refs
(Contract AF 19(628)-4015)
(AFCRL-65-680; AD-624305) CFSTI: HC $4.00/MF $0.75

The objective of the work is the development of a computerized linguistic basis for application to practical and theoretical problems in automatic language processing. The three main parts of work are: (1) a formalism for expressing grammatical information, (2) a sentence analysis procedure based on the formalism, and (3) a grammar of English expressed in terms of the formalism, but motivated by transformational theory. A detailed description of the processing of a sample sentence is given. Some new schemes, possessing certain desirable properties, for organizing records with binary valued attributes were defined. It was shown that it is possible to construct these filing schemes using finite geometries. The search time for query involving any attributes for these filing schemes based on finite geometries is very small in comparison with existing filing schemes. Moreover, the search time does not depend on the number of records. The problem of updating is also quite simple. Author (TAB)

N66-15727*# Stanford Univ., Calif. Dept. of Genetics.
AN OPERATING SYSTEM FOR THE LINC COMPUTER
Richard Kelly Moore 1 Nov. 1965 175 p
(Grants NSG-81-60; NIH G-FR-00151-01; AF-AFOSR-886-65; Contract AF 49(638)-1599)
(NASA-CR-69534; IRL-1038) CFSTI: HC $4.00/MF $1.00
CSCL 09B

The Linc, a general purpose, solid state, digital computer designed for high speed data handling in the laboratory, is evaluated, and the development of an operating system with a higher level language capability is described. Also discussed is the Linc operating system (Loss), under which programs can be created, updated, and used; details are given on its basic components, including the monitor, files, the program stack, and various utility programs. The use of in-core Loss features for certain utility routines and as an inter-program communication buffer is described, along with their relation to the total Loss operational structure. Details are also given on Blink, a version of Subalgol designed for use with the Linc; programs similar to Subalgol programs are translated on the IBM 7090 by the Blink compiler into relocatable Linc code. Data on the language description, input–output techniques, and compilations are included. It is also pointed out that the separation of programming from execution functions seems to be an approach that deserves general consideration in evaluating the role of smaller computers. M.G.J.

N66-15804# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE EXPANSION OF A CIRCLE OF PROBLEMS, SOLVED WITH THE AID OF SMALL SCALE DIGITAL MACHINES
V. I. Gorushkin, A. A. Krumin, and T. S. Latysheva 14 Sep. 1965 9 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 7, 1962 p 28–29
(FTD-TT-65-1228/1+4; AD-621795) CFSTI: HC $1.00/MF $0.50

A method is described for the solving of certain energy and electrical engineering problems. The method is highly useful for solving problems where great accuracy is required. The method is applicable to digital computers with fixed comma. The change over to operation with floating comma types considerably increases the program volume and the time required for the solution. E.E.B.

N66-15808*# Stanford Research Inst., Menlo Park, Calif.
FLUX SWITCHING IN MULTIPATH CORES
D. Nitzan and V. W. Hesterman Jul. 1965 205 p refs Prepared for JPL *Its* Rept.-4
(Contracts NAS7-100; JPL-950095)
(NASA-CR-69565) CFSTI: HC $6.00/MF $1.25 CSCL 09B

In the total $\dot{\phi}(t)$ waveform of a ferrite core switched by mmf, F(t), from negative remanence, $\phi = -\phi_r$, three components are distinguished: elastic, decaying inelastic, and main elastic. A computer program is written and applied in computing $\dot{\phi}(t)$ and its components for a thin toroidal ferrite core. The results agree well with experimental $\dot{\phi}(t)$ waveforms obtained by using F(t) with different rise times and different amplitudes. Numerical analyses and computer programs are given for three additional magnetic circuits: a loaded core, a core-diode-transistor binary counter, and a loaded, saturable, three-leg core. The binary-counter program includes computation vs. time of three currents and F, $\dot{\phi}$, and ϕ of each of two coupled cores during the fast-switching mode of operation of a single stage in the counter. The switching properties of a thin-ring core in response to a ramp drive, F = kt, have been investigated for k varying from 0.1 to 10 amp-turn/μsec. Experimental $\dot{\phi}_p(k)$ and $t_p(k)$ curves are compared with computed curves based on the parabolic model $\dot{\phi} = \lambda(F-F_0)^p\ [1-(2\phi + \phi_s - \phi_d)^2/(\phi_s + \phi_d)^2]$. A study was made of the effect of temperature on the switching properties of two square-loop ferrite toroids. Temperature coefficients have been found for the parameters of the model described above. Author

N66-15930# System Development Corp., Santa Monica, Calif.
ADVANCED COMPUTER TECHNIQUES APPLICABLE TO SPACE AND RANGE PROBLEMS
Gerald D. West 25 Oct. 1965 17 p
(SP-2197; AD-623738) CFSTI: HC $1.00/MF $0.50

Computer installations serving range and space needs are characterized by a large number of user organizations, a variety of processing tasks, and rapid growth. These characteristics tend to result in problems in computer utilization. Certain advanced programming concepts such as time-sharing and multi-processing seem to provide the means for alleviating the computer utilization problems being experienced by range and space support installations. These concepts are a part of the methodology of the computer applications field, and are distinct from the functional requirements of the computer user. Author (TAB)

N66-15984*# New York Univ., N. Y. Lab. for Electroscience Research.
GRAPH PAK I—A THREE-DIMENSIONAL MANIPULATION PROGRAM
Michael Adamowicz 10 Sep. 1965 52 p refs *Its* Tech. Note No. 400-24(Grant NGR-33-016-038)
(NASA-CR-69665) CFSTI: HC $3.00/MF $0.50 CSCL 09B

This report describes the development and use of Graph-Pak I, a 3-dimensional manipulation and plotting program. This program was written for a PDP-5 digital computer with a 4K memory and a CALCOMP digital plotter. It enables the user to describe an object in terms of points and straight lines and then obtain a perspective drawing of the object in any desired orientation. In addition, certain kinds of distortions and alterations can be made without having to redescribe the object; however, there is no provision for removing hidden lines. Author

N66-16001# Army Missile Command, Huntsville, Ala. Management Science and Data Systems Office.
THE IMPACT OF ADP ON THE FUTURE MANAGERIAL ENVIRONMENT
Bruce L. Garrett 15 Jun. 1965 82 p refs
(RSIC-438; AD-472768)

A synthesis of predicted Automatic Data Processing (ADP) developments in terms of their relationships to the total management of an organization, directed primarily to managers faced with a growing demand for better ADP utilization. ADP equipment capabilities likely to be available during the next decade are outlined in detail. Current techniques for the use of ADP systems and problems involved in installing improved future applications are discussed. A timetable is shown predicting the general acceptance and use of applications leading to maximum economical computer utilization. The ADP displaced worker situation is portrayed and actions for its alleviation are suggested. Statistics covering situations where ADP actually displaced workers are shown in graphic form. Managerial approaches to coping with systems integration, personnel training, and organizational structure evolving from an ADP influenced society are presented. Author (TAB)

N66-16003* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
SYSTRAN (SYSTEMS ANALYSIS TRANSLATOR): A DIGITAL COMPUTER PROGRAM Technical Report, Aug. 1962–Oct. 1964
D. J. La Jeunesse, E. B. Weis, Jr., and T. J. Hogan, Jr. (Technology, Inc.) Jul. 1965 322 p refs
(Contract AF 33(616)-10010)
(AMRL-TR-65-133; AD-624468) CFSTI: HC $7.00/MF $1.50

The mechanics, mathematics, and usage of a program written in Fortran IV and MAP for the IBM 7094 are described. The program is called Systran (Systems Analysis Translator) and it includes subroutines for most of the common tools for frequency domain analysis of linear systems (such as Fourier transforms and inverse Fourier transforms, complex algebra, and correlation functions). The report is essentially an instruction manual. It contains a discussion of all aspects of the program essential to competent usage. Author (TAB)

N66-16019*# Maryland Univ., College Park. Computer Science Center.
SUBROUTINES FOR DIGITAL COMPUTATION OF CHEMICAL ENGINEERING PROBLEMS, PART I
Chan M. Park Oct. 1965 85 p refs
(Grant NsG-398)
(NASA-CR-69661; TR-65-24) CFSTI: HC $3.00/MF $0.75 CSCL 09B

This report contains a collection of subroutine programs developed for chemical engineers and chemical engineering students to aid in the solution of their problems. Rather than developing all-purpose general routines with many options which often make them difficult to use, these subroutines were developed with emphasis on practical applicability in the chemical engineering field and organized to make them usable with a minimum of effort. The subroutines described in this paper are basic and are frequently required in the reduction of experimental data to usable form as well as in the solution of computer-oriented chemical engineering problems. Both FORTRAN II and FORTRAN IV versions are provided so that a user can choose according to his control program. Control programs as well as numerical results are also included for each subroutine to illustrate its usage. Since there are only small differences between the programs in FORTRAN II and FORTRAN IV, only FORTRAN II program listings are given in the appendices at the end of this report. Author

N66-16040# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
DIGITAL TIME DIFFERENCE ADAPTER FOR THE APN-152 LORAN C RECEIVER Final Report
Aug. 1965 66 p
(Contract FA-WA-4659)
(GRR-65-1084; RD-65-97)

With the advent of digital computers capable of generating aircraft navigation and control functions from hyperbolic time difference inputs, it is necessary to provide an interface between the receiver and the computer. This problem has been handled by an electro-mechanical encoder in the past, but it is apparent that the analog-to-digital interface can be accomplished electronically by an all solid state microminiature unit. The adapter has been designed and constructed and tests performed show acceptable accuracy of conversion with a minimum modification to the receiver. It has been determined that the adapter concept will be compatible with all present-day airborne Loran C Receivers, including the ARN-78. Author

N66-16048*# Philco Corp., Palo Alto, Calif. Western Development Labs.
CERTAIN COMPUTER PROGRAMS Fourth Quarterly Progress Report
24 Sep. 1965 63 p ref
(Contract NAS5-9700)
(NASA-CR-69694; WDL-TR-2605) CFSTI: HC $3.00/MF $0.75 CSCL 09B

Progress is reported in developing computer programs in the Advanced Error Propagation Program (AEPP). Programming effort is emphasized in three areas: precision trajectory and targetting, tape read and write, and patched-conic error propagation. A description is given of the trajectory and targetting developments and includes, in addition to integration of a perturbed lunar or interplanetary trajectory, the refinement of launch conditions so that the precision trajectory will satisfy prescribed target constraints. Also described is the method used to provide the reference trajectory for error propagation. Further effort was put toward writing error propagation output information on tape for plotting and other purposes. An explanation is given of the state of completion and checkout of the patched conic error propagation program which was developed as a framework for checkout of the input-output, error propagation, and measurement processing subroutines for the AEPP. Derivations of the measurement partials or sensitivities of the various measurements to deviations in the expanded state are appended. C.T.C.

N66-16050*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TELEMETRY DATA PROCESSING
Sep. 1965 54 p
(NASA-TM-X-55351; X-564-65-384) CFSTI: HC $3.00/MF $0.50 CSCL 09B

The data from scientific instruments aboard satellites are recorded on magnetic tapes at the data acquisition network stations and sent to information processing divisions for evaluation, processing, reducing, and further preparation for analysis. Further responsibilities include spacecraft attitude computation, additional processing of experiment data by request of the experimenter, and processing of spacecraft subsystem data. This document tells how the above-mentioned tasks are accomplished by data processing branches. Author

N66-16143# European Atomic Energy Community, Brussels (Belgium).
SAHYB (SIMULATION OF ANALOGUE AND HYBRID COMPUTER): A GENERAL PURPOSE PROGRAMME FOR THE SOLUTION OF INITIAL AND BOUNDARY VALUE PROBLEMS
H. D'Hoop and R. Monterosso 1965 59 p refs
(EUR-2519.e) CFSTI: HC $3.00/MF $0.50

The purpose of the Sahyb (simulation of analogue and hybrid computer) program is to concentrate in one subroutine an initial value problem, and in two subroutines a boundary value problem. The other subroutines are already prepared and handle the following operations: output of results, modification of integration and/or print-out step, interpolation of tabulated functions, fixed or variable delays, and plot of curves on Calcomp plotter. Sahyb is designed to be used by physicists or engineers who are not specialists in programming. Moreover being written in Fortran and FAP, it can be modified and adapted to special cases. In particular it is addressed to analogue computation engineers who need an easy way to obtain digital solutions to be compared with analog results. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N66-15209# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
QUARTZ CRYSTAL AGING EFFECTS Semiannual Report, 15 Feb.–15 Aug. 1965
Richard B. Belser and Walter H. Hicklin Sep. 1965 46 p refs
Its Rept.-9
(Contract DA-36-039-AMC-02251(E))
(ECOM-02251(E)-9; AD-623703) CFSTI: HC $2.00/MF $0.50

Aging studies of 3 Mc units were made. Aging rates for cultured and swept cultured resonators were in the range 2 to 4×10^{-9}/week during a 125 day period. The cultured units possessed a slightly higher average rate, 3.4×10^{-9}/week, than the swept cultured ones, 2.5×10^{-9}/week. Two units designated as cultured quartz exhibited frequency shifts of −.000007 when exposed to .0000014 rads of irradiation from a Cs-137 source. Post irradiation aging was at a rate of 2.5×10^{-8}/week, approximately 8 times the normal rate. These units, because of the frequency shifts appear to be natural quartz improperly designated. Cultures swept units, similarly irradiated, exhibited no appreciable frequency shift or post irradiation aging. One 3 Mc unit of swept cultured quartz exhibited virtually no change in aging rate as a result of continuous drive at a 400 microamp level. An ultrasonic bonding method for welding aluminum ribbon to aluminum plated resonators was developed and gave strain free bonds and resonators of high Q, .0000015, and of low unwanted mode intensity. TAB

N66-15211# Watkins-Johnson Co., Palo Alto, Calif.
DEVELOPMENT AND DELIVERY OF A VERY LOW-NOISE TRAVELING-WAVE TUBE AMPLIFIER Final Report, 1 Jul. 1963–1 Apr. 1965
J. N. Nelson [1965] 89 p refs
(Contract DA-36-039-AMC-03253(E))
(Rept.-6; AD-623609) CFSTI: HC $3.00/MF $0.75

The report describes the design and development of the WJ-276-6, a 5 dB terminal noise figure, 8.0 to 12.0 Gc/s, permanent magnet focused traveling wave tube amplifier with integral power supply. The major problem in the development was reducing the terminal noise figure to less than 5 dB, while keeping the weight of the amplifier to less than 15 pounds. This problem was solved by the use of a hybrid straight field magnet, which provided a peak magnetic field of 1500 gauss in the critical region of the cathode and electron gun; a high gamma a, low RF loss helix assembly; a novel thin-rim cathode and flexible low noise gun assembly; and low RF loss waveguide input coupling. The report describes the important design considerations and the effect of the design parameters on traveling wave tube performance. A physical description of the tube is presented along with inportant fabrication and measurement techniques. The progress which lead to the final design is chronicled, and the initial and final design values compared. Author (TAB)

N66-15219# Cutler-Hammer, Inc., Deer Park, N. Y. Airborne Instruments Lab.
FREQUENCY MULTIPLIER Quarterly Report, 1 Jun.–31 Aug. 1965
G. P. Kurpis and J. J. Taub [1965] 32 p
(Contract DA-28-043-AMC-00438(E))
(QR-3; AD-624111) CFSTI: HC $2.00/MF $0.50

During this quarter, the following frequency multipliers were designed and fabricated: 50 to 100 Gc cross-guide type varactor doubler, 25 to 50 Gc in-line type varactor doubler, 8.333 to 25 Gc resonant cavity-type varactor tripler. Preliminary tests on the two varactor doublers were performed. Small outputs were obtained in both cases and both doublers are presently undergoing slight modifications to improve their operation efficiency. A 50 to 100 Gc in-line type varistor doubler also has been tested. The results of this test surpassed the varactor doubler performance by a small margin.
Author (TAB)

N66-15347*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHOTON-ACTUATED MULTIPLEX SWITCH DEVELOPMENT
Daniel Bergens 15 Dec. 1965 29 p
(Contract NAS7-100)
(NASA-CR-69291; JPL-TR-32-794) CFSTI: HC $2.00/MF $0.50 CSCL 09A

A photon-actuated electronic switch has been developed for multiplexing low-level analog signals. The device represents a significant advance in this type of solid-state switching in terms of miniaturization, speed, simplicity, and potential reliability. The switch consists of a gallium arsenide diode, as an infrared light source, and a double-emitter silicon transistor that detects the infrared photons and acts as the switch. Efficient coupling between the diode and the transistor has been achieved. Device development, theoretical considerations, problem areas, and test results are covered. Author

N66-15392*# Georgia Inst. of Tech., Atlanta.
THE EFFECT OF LOAD CONDUCTANCE ON THE SELECTIVITY OF NOTCH FILTERS
Kendall L. Su [1965] 11 p refs
(Grant NGR-11-002-020)
(NASA-CR-69341) CFSTI: HC $1.00/MF $0.50 CSCL 09E

It has been found that notch filters using hyperbolically shaped RC lines have less fluctuations in selectivity due to load than those using exponentially shaped lines; the latter, in turn, fluctuate less than those using trigonometric lines. The longer a hyperbolic line is, the less it is affected by the load. Author

N66-15421*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SELECTIVE ELECTROPLATING OF ETCHED CIRCUITS
Charles E. Whitfield, Sr. and Howard Herzig [1964] 7 p refs Submitted for Publication
(NASA-TM-X-54974) CFSTI: HC $1.00/MF $0.50 CSCL 07D

A technique has been developed for producing boards on which only the conductive paths between terminals are gold plated, the pads themselves being plated with some more desirable metal. Separate positive films of the conductor and terminal pad patterns are used to sequentially produce the photoresist masks required for the plating of each area with its respective metal. A negative of the entire circuit is then used to produce a new photoresist mask covering the circuit, so that the unwanted copper can be etched away. Author

N66-15426# Centre de Physique Electronique et Corpusculaire, Orsay (France).
HALF MILLIMETER "BACKWARD WAVE" OSCILLATOR Second Technical Progress Report, Apr. 1–Jun. 30, 1965
Jul. 1965 27 p
(Contract AF 61(052)-814)
(WR-1421; RADC-TR-65-437; AD-623584) CFSTI: HC $2.00/MF $0.50

Progress is reported on the electron gun study; including magnetic shield studies, electrolytic tank measurements, gun hot tests, and cold tests of the slow-wave structure for a O-type Carcinotron with a center frequency of 500 K Mc/s. TAB

N66-15471# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Electronics, Control and Instrumentation Development Branch.
GENERAL PURPOSE SUBASSEMBLIES
Jun. 1965 47 p
(AECL-2294; ELI-91) CFSTI: HC $2.00/MF $0.75

Schematics and descriptive specification sheets are presented on subassemblies of proven design which may be of general use in instrumentation systems. The items covered include: amplifier, discriminator, bistable, ratemeter pumps, dc amplifier, BF3 counter and preamplifier, cut amplifier, 5 Mc/s gated oscillator, fast scaler ÷ 64, slow scaler ÷ 64, four fast bistables, and input mixing monostable. Most of the subassemblies are printed circuit boards; in cases where the item consists of a printed circuit board that will fit or plug into a standard card container, the information is given in the specification. M.G.J.

N66-15506# Comitato Nazionali per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali.
ATTAINABLE RESOLUTIONS OF ELECTROSTATIC DEFECTIONS OF A CATHODE RAY TUBE AND THEIR UTILIZATION IN A PHOTOGRAM READER FOR A MONOGAP SPARK CHAMBER [RISOLUZIONI RAGGIUNGIBILI CON ALCUNI TRC A DEFLESSIONE ELETTROSTATICA E LORO UTILIZZAZIONE IN UN DISPOSITIVO DI LETTURA DI FOTOGRAMMI DI CAMERE A SCINTILLA MONOGAP]
M. Avaltroni and F. Pandarese 25 Sep. 1965 23 p refs In ITALIAN *Its* Internal Note No. 290
(LNF-65/33) CFSTI: HC $1.00/MF $0.50

An apparatus for analyzing photograms of a monogap spark chamber is described. The apparatus consists of a tektronix oscilloscope, lenses, a grating, and a photomultiplier. Noise sources caused by modulation intensity, phosphorus granules on the cathode ray tube, photo contrast; and achievement of an optimum signal to noise ratio are examined.
Transl. by P.F.E.

N66-15522# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali.
MEASUREMENT OF IMPEDANCE AT 23 Gcps AT LOW TEMPERATURE [MISURE DI IMPEDENZA SUPERFICIALE A 23 Gcps A BASSE TEMPERATURE]
G. Baldacchini and V. Montelatici 8 Sep. 1965 36 p refs In ITALIAN *Its* Internal Note No. 289
(LNF-65/32) CFSTI: HC $2.00/MF $0.50

A lead telluride cavity resonator and circuitry for measuring superficial impedance in the microwave region (23 Gigacycles) reaching 1.5° K are described. Transl. by P.F.E.

N66-15549# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali.
INTENSIFICATION OF IMAGES AT THREE STAGES OF MAGNETIC FOCUSING [INTENSIFICATORE DI IMMAGINE A TRE STADI A FOCALIZZAZIONE MAGNETICA]
R. Habel, T. Letardi, and G. Marangoni 10 Sep. 1965 18 p refs In ITALIAN *Its* Nota Interna No. 223
(LNF-65/31) CFSTI: HC $1.00/MF $0.50

A high gain, three stage image intensifier utilizing negative focusing is described. The tube housing is fabricated in three sections, each section containing a semitransparent photocathode and fluorescent screen on opposite walls. Image focusing in each stage is accomplished by a combination of an electric field and static magnetic field directed along the axis of the tube. Specifications for the device are: CsSb–O photocathode; ZnS–Ag fluorescent screen; blue fluorescence color; t^{-n} decay; 10^{-4} sec average life; magnetic focusing; 50 kV maximum working voltage; 5×10^3 gain; and 10 lines/mm resolution. Transl. by P.F.E.

N66-15555# Physics Lab. RVO-TNO, The Hague (Netherlands). Microwave Dept.
A STUDY ON RECIPROCAL PHASE SHIFTERS USING FERRITES IN C-BAND WAVEGUIDE
J. Snieder Jul. 1965 128 p
(Ph.L.1965-33; TDCK-43551) CFSTI: HC $4.00/MF $1.00

The results of a study on reciprocal ferrite phase shifters is given. The phase shift and the losses of two configurations are measured and the onset of non-linearity of one of these configurations. The temperature and frequency dependence is measured for both configurations on all commercial ferrites examined here. Author

N66-15592*# Battelle Memorial Inst., Columbus, Ohio.
AN ADVANCED THERMOELECTRIC COMPONENT DEVELOPMENT PROGRAM Interim Progress Report
W. E. Kortier 17 Sep. 1965 110 p refs
(Contract NAS5-9160)
(NASA-CR-69442; BAT-5-9160-1) CFSTI: HC $5.00/MF $0.75 CSCL 09A

The tasks represented under this program are intrinsically separated by their diverse technologies and are reported herein as separate chapters. Under Task I, Computer Program Modification, a new program based upon the extension and generalization of an existing program has been written, debugged, and operated. The program in its present form is capable of analyzing thermoelectric generators for space use where the design under investigation uses the static heat transfer mode and geometries based upon right-cylindrical configurations. A rapid means of analysis, which can treat large numbers of cases in order to identify minimum weight designs, is now available as a fundamental tool in lieu of time-consuming and repetitive manual computations. The work performed under Task II, High-Temperature Segmented Thermoelectric Development, has progressed to the point where several schemes are proposed for element fabrication. These schemes are based upon fundamental studies of thermoelectric-materials properties, transition-member bonding between SiGe and PbTe materials, hot-shoe bonding to GeSi material, and PbTe-segment fabrication using an iron–tin shoe alloy material with an expansion coefficient midway between iron and PbTe. Under Task III, Development of a Thermal Insulation and Support Structure, bonding-process optimization has been completed. Specimens composed of multilayered webs and foil and representing variances in web and foil thickness and web spacing have been fabricated. An indication of the surface emittance of the finished insulation structures was obtained by measuring the surfaces of a selected Hastelloy C coupon.
Author

N66-15648# Hughes Aircraft Co., Newport Beach, Calif. Microelectronics Div.
SEMICONDUCTOR DESIGN EFFECTS ON RADIATION RESISTANCE Quarterly Report, 15 Mar.–15 Jun. 1965
Brian D. Gallagher and Vincent R. Honnold Nov. 1965 35 p ref
(Contract DA-28-043-AMC-00418(E))
(ECOM-00418(E)-2; AD-624509) CFSTI: HC $2.00/MF $0.50

The standard 2N708 geometry transistors and the special structures including the PNP transistor fabrication were completed. The entire set of primary photocurrent measurements were completed under conditions where the radiation pulse was long compared to the minority carrier lifetime of the material. This is in contrast to the non-equilibrium measurements made on a few samples and reported during the first quarter. Numerical results are given. Preliminary measurements on bar geometries have proven inconclusive and a repetition of this experiment is planned for the next quarter. The equations describing the steady-state distribution of excess carriers previously derived are further expanded. Author (TAB)

N66-15651# Radio Corp. of America, Somerville, N. J. Electronic Components and Devices.
DEVELOPMENT OF TRANSISTOR–VARACTOR DIODE CAPABLE OF 5 WATTS OUTPUT AT 2.3 GIGACYCLES Interim Technical Report, 1 Jun.–31 Aug. 1965
P. L. Mc Geough and H. C. Lee [1965] 51 p refs
(Contract AF 33(615)-2486)
(ITR-1; AD-624566) CFSTI: HC $2.00/MF $0.50

Recently obtained overlay transistor data for devices with surface geometries similar to the proposed device, coupled with advances in photolithographic techniques, have resulted in a redesign of the device surface geometry. This new design, which has resulted in a factor of two increase in emitter-base periphery over the originally proposed structure with no increase in device junction areas, should result in a significant improvement in device performance capability. The benefits associated with this new structure require process improvements, particularly in the area of mask fabrication, photolithographic techniques and diffusion techniques. The required photomasks have been designed and engineering drawings are being prepared. Studies of various photoresist techniques

are being evaluated to determine optimum coating, exposure and developing procedures for the new structure. The effects of various diffusion schedules on UHF performance are being investigated using 'unitcell' structure as the experimental vehicle. Diffusion runs are in process to determine the influence of shallow junction depths and thin epitaxial layers on device performance. A stripline package has been designed and piece parts ordered for initial fabrication and evaluation of this case. TAB

N66-15656# Naval Ordnance Lab., White Oak, Md.
THE TUNNEL JUNCTION NEURISTOR
Alfred J. Cote, Jr. Dec. 1965 112 p refs
(NOL-TR-65-60; AD-624590) CFSTI: HC $4.00/MF $0.75

One of the components potentially useful in microelectronics systems is the neuristor, a distributed-active transmission line having pulse propagation properties similar to those of a nerve fiber. The current status of the Naval Ordnance Laboratory's attempts to realize a practical neuristor device by employing a novel tunnel diode structure is contained in this report. Attempts at neuristor realization are reviewed and the basis is described for the approach based upon tunnel diode structures. The experimental results obtained on a variety of the latter devices are included, along with a discussion of some improved methods of trigger-coupled network realization. Propagation velocities on the order of 10 000 meters per second were measured over path lengths as great as 0.4 inches. Possible propagation mechanisms are discussed. The operation of a trigger junction was demonstrated but attempts to demonstrate a unilateral junction were inconclusive. Coupling of pulses between different lines via the substrate was also encountered along with a phenomenon having implications as a possible inhibit mechanism for refractory junctions.
Author (TAB)

N66-15657# Centre de Physique Electronique et Corpusculaire, Orsay (France).
HALF MILLIMETER "BACKWARD WAVE OSCILLATOR" Summary Report, 1 Jan.–30 Sep. 1965
Yeou Ta 31 Oct. 1965 34 p
(Contract AF 61(052)-814)
(WR-1456; RADC-TR-65-519; AD-624695) CFSTI: HC $2.00/MF $0.50

The final objective of this work is to construct a half millimeter backward wave oscillator with a power level in the range of half a watt. In this first step, an electron gun with a beam density of about 1200 A/sq cm in the ten kilovolts range has been studied. The overall technology of the tube has also been examined. Guns and delay line test results are given.
Author (TAB)

N66-15661# Naval Research Lab., Washington, D. C. Chemistry Div.
SURFACE CHEMICAL METHODS OF DISPLACING WATER AND/OR OILS AND SALVAGING FLOODED EQUIPMENT. PART 5: FIELD EXPERIENCE IN REMOVING SEA-WATER SALT RESIDUES, SAND, DUST, AND SOLUBLE CORROSIVE PRODUCTS FROM AN/FPS(XN-1) MISSILE-TRACKING AND SATELLITE-TRACKING RADAR
H. R. Baker and P. B. Leach 15 Oct. 1965 20 p refs
(NRL-6334; AD-624293) CFSTI: HC $1.00/MF $0.50

Surface chemical techniques were previously developed at this laboratory for the removal of oily and/or electrolyte contamination and the displacement of water from electrical and electronic equipment. Recently, these techniques were applied to the reconditioning of an AN/FPS-16(XN-1) radar which was badly contaminated with sea-water salt, sand, and dust after operation for several years near the beach at Patrick Air Force Base, Cape Kennedy, Florida. The method consisted of cleaning removable sections in an ultrasonic bath of emulsion cleaner, rinsing them with water, and spraying them with a water-displacing composition. Nondetachable parts were treated in a similar manner, except the emulsion cleaner was sprayed on. These methods proved to be successful in reconditioning the radar system, which consisted of the antenna and an extensive assembly of trailer-housed electronic gear and control console.
Author (TAB)

N66-15682# Battelle Memorial Inst., Columbus, Ohio.
RELIABILITY PHYSICS NOTEBOOK
J. Vaccaro (Rome Air Develop. Center) and H. C. Gorton, ed. Oct. 1965
(Contract AF 30(602)-3504)
(RADC-TR-65-330; AD-624769) CFSTI: HC $6.00/MF $1.50

The results of physical and chemical investigations on basic mechanisms and processes in materials which cause or contribute to degradation, aging, and failure of electronic devices are summarized. Data is presented, in practical form wherever possible, for use by design and test engineers concerned with the assessment, prediction, and improvement of the realiability of solid state electronic devices. Techniques and procedures for obtaining data on specific part types and for applying such data to accelerated testing, screening, and reliability prediction programs are discussed. Format of the report is designed to facilitate periodic revision and inclusion of results of future investigations in basic failure mechanisms in electronic materials.
Author (TAB)

N66-15705# Tung-Sol Electric, Inc., Bloomfield, N. J.
EVALUATION OF ELECTRON MULTIPLIER TUBE AND CIRCUITRY Final Report
T. Stafford 1 Jun. 1965 56 p
(Contract Nonr-4719(00) (X))
(AD-624588) CFSTI: HC $3.00/MF $0.50

The secondary emission electron multiplier tube type 8428 was evaluated to determine operating conditions and power supply requirements. Effect of interelectrode voltage variation on output pulsd voltage was determined. Circuits for supplying dynode voltages, overload protection, and grid input were designed. Grid characteristics were investigated and proper bias voltage and input signal level were sea. Tube characteristics were measured at several anode voltage levels and the effect of varying the duty cycle was measured. Data, circuit diagrams, and photographs of the output pulse are included. It was found thaf the output pulse characteristics of the 8428 are well suited for driving a TWT grid. Author (TAB)

N66-15707# Hughes Aircraft Co., Fullerton, Calif.
HYBRID COMPUTATION OF TRANSIENT RADIATION EFFECTS ON ELECTRONICS Final Report
J. E. Bell 1 Mar. 1965 46 p refs *Its* Rept.-65-10-46
(Contract AF 04(694)-565)
(AD-624559) CFSTI: HC $2.00/MF $0.50

Hybrid computers have been investigated to determine their particular usefulness in TREE prediction programs. Several approaches for using hybrid computers have been investigated and the merits of each compared with all analog or all digital computation. The advantages of analog, digital and hybrid computer applications to one particular problem are discussed. Data are presented for a hybrid solution of the pre-preamplifier prompt gamma radiation response. Author (TAB)

N66-15708# Microwave Physics Corp., Garland, Tex.
WIDEBAND ELECTRONICALLY TUNABLE FILTERS FOR VHF–UHF BAND Technical Report, Apr. 1964–Mar. 1965
George H. Thiess Griffiss AFB, N. Y., RADC, Intelligence Appl. Branch, Nov. 1965 92 p refs
(Contract AF 30(602)-3418)
(RADC-TR-65-286; AD-624360) CFSTI: HC $3.00/MF $0.75

Measurements of linewidth and Q have been made at frequencies from 90 Mc to 1000 Mc on 40 gallium substituted YIG resonators. Both spheres and discs were measured by a dynamic technique in which a resonator coupled energy between two coaxial lines. A complete description of the experimental setup is given and the data obtained is analyzed. The measured Q of gallium substituted YIG was found to be too low for practical filters at frequencies below 200 Mc at all temperatures from room temperature up to tha curie temperature of the resonator. It is also predicted, from theoretical considerations, that at no other temperature higher than 10° K, is the Q likely to be any higher. It is recommended that further development of low magnetization materials be carried out, with the special aim of producing materials free of gradients and with low cutoff frequencies. The insertion loss of the UHF filter was typically 3 to 4 db across the 300 Mc to 1000 Mc band. The VHF filter was approximately 4 db except at 90 Mc where it rose to 11.5 db. It is concluded that YIG filters are probably not practical at frequencies below 200 Mc unless improved materials become available. Author (TAB)

N66-15722# Research Triangle Inst., Durham, N. C.
INTEGRATED SILICON DEVICE TECHNOLOGY. VOLUME IX: EPITAXY, JANUARY–JULY 1965
B. M. Berry Aug. 1965 167 p refs
(Contract AF 33(615)-1998)
(ASD-TDR-63-316, Vol. IX; AD-624520) CFSTI: HC $5.00/MF $1.00

The report discusses the theory, methods and practical applications of silicon epitaxy. Uniform impurity profiles, which are not practical in diffused layers, are readily obtainable by epitaxy since impurities are added to the growing layer. Epitaxial layers can be formed much faster than diffused layers; but thickness control of multilayers is easier with diffusion. Techniques of epitaxy and diffusion combine to provide an improvement in integrated circuit performance not possible by diffusion alone. Models for the epitaxial growth process and a brief description of defects occurring in imperfect epitaxy are given. The methods of epitaxially depositing silicon, both vapor phase and vacuum techniques, are explained. Evaluation techniques for silicon epitaxial wafers, e. g., thickness measurements and impurity and resistivity profile determination, are presented. The application of epitaxy to device structures and the improved performance in these structures brought about by epitaxy are discussed. Author (TAB)

N66-15764# TRG, Inc., Melville, N. Y.
WIDEBAND CRYOGENIC PARAMETER AMPLIFIER First Technical Report, May–Sep. 1965
R. P. Damiano Griffiss AFB, N. Y., RADC, Nov. 1965 12 p refs
(Contract AF 30(602)-3768)
(RADC-TR-65-395; AD-624549) CFSTI: HC $1.00/MF $0.50

Theoretical optimum gain-bandwidth product design curves are presented for a two-port non-degenerate parametric amplifier. These curves are based on the parameters of the Sylvania GaAs varactor diode. Included is a prototype amplifier design based on the data obtained from these curves. Measurements taken on a ferrite circulator operating at room temperature, 77°K, and 30°K indicate that an octave band circulator covering the 4–8 gc band can be designed to operate from room temperature down to cryogenic temperatures. Author

N66-15768*# Cornell-Dubilier Electronics Div., Federal Pacific Electric Co., Norwood, Mass.
DESIGN, DEVELOPMENT AND MANUFACTURE OF HIGH RELIABILITY COMPUTER GRADE MINIATURE CAPACITORS Final Report, 30 Jun. 1964–18 Sep. 1965
[1965] 10 p ref
(Contract NAS8-11701)
(NASA-CR-69541) CFSTI: HC $1.00/MF $0.50 CSCL 09A

Results of experimental work performed on four types of capacitors to determine their electrical properties are reported. The four capacitors consisted of: (1) a thin film of polyurethane deposited on aluminum foil, metallized and wound; (2) layers of thin pieces of a special barium titanate ceramic stacked in parallel; (3) thin films of barium, stronium and titanium oxides stacked in parallel; and (4) a non-electrolytic anodized tantalum foil capacitor either wound or layered. The non-electrolytic tantalum capacitor was selected as the device having the best chance of meeting the contract requirements. M.R.W.

N66-15786*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMMUNICATION THEORY APPLIED TO ANTENNA SYSTEMS
William Welch Nov. 1965 36 p refs
(NASA-TM-X-55347; X-525-65-469) CFSTI: HC $2.00/MF $0.50 CSCL 09F

The properties of an antenna system are determined not only by the antenna but also by the electronics associated with the antenna. For this reason, there is an important area in the field of antenna research where the antenna is treated as a signal processing device rather than simple transducer. Many of the published papers that analyze this type of antenna system use a terminology which is closer to that of communication theory than antenna theory. To understand such papers the reader must be knowledgeable in both fields. This is not the usual case and the purpose of this report is to define some of the fundamental concepts of communication theory and show how they can be applied to antenna systems. Some results of Fourier (harmonics) analysis and linear circuit theory are reviewed and analogous results are developed for antenna systems. The emphasis throughout has been placed on the physical interpretation of concepts and not on the mathematics used to derive or define the concepts. Author

N66-15816*# International Business Machines Corp., Rockville, Md. Federal Systems Div.
A ROD DESIGN FEASIBILITY REPORT, VOLUMES I AND II Final Report
20 Mar. 1963 365 p refs
(Contract NAS8-5098)
(NASA-CR-69571; IBM-TR-023-022) CFSTI: HC $7.00/MF $2.00 CSCL 09F

Airborne Ranging and Orbit Determination (AROD) is found to be a feasible concept, and a representative economical state-of-the art system has been designed. Performance curves are developed which can relate measurement accuracies to equipment penalties. Vehicle equipment is entirely solid state, the vehicle antenna provides horizon-to-horizon coverage, and the ground transponder features a multi-beam antenna which gives considerable gain with almost complete hemispherical

coverage. The spacecraft receiver amplifies and separates the signals retransmitted from three or four ground stations. These and other data enter the vehicle guidance computer where orbit-determination is calculated. System analysis, system design, and equipment implementation are considered in detail in the first volume. The second volume deals with the geometrical dilution of precision, errors introduced by the propagation medium, geodetic aspects of the system, and various mathematical derivatives. M.W.R.

N66-15818*# TRW Systems, Redondo Beach, Calif. Physical Electronics Lab.
A SOLID-STATE LOW-NOISE PREAMPLIFIER
D. O. Hansen and N. L. Roy Jun. 1965 13 p refs
(Contract NASw-936)
(NASA-CR-69575; STL-4158-6011-TU-000) CFSTI: HC $1.00/MF $0.50 CSCL 09C

An all solid-state, voltage-sensitive preamplifier with low noise and broadband response is described that can be used in conjunction with a detector to measure particle velocity and particle charge in an electrostatic hypervelocity accelerator test system. This preamplifier achieves large resistance and small effective capacitance through the use of a bootstrap loop incorporating a field effect transistor at the input stage. Equivalent input resistance of the preamplifier is 10^{10} ohms, and bootstrapping reduces the effective input capacitance to about 1 pf. For a pass band of 10 kc to 10 Mc the equivalent rms input noise charge is about 250 electrons. A complete circuit diagram of the preamplifier is shown. G.G.

N66-15823*# Texas Instruments, Inc., Dallas. Apparatus Div.
INTEGRATED CIRCUIT SEQUENCE GENERATOR Final Engineering Report
F. D. Clark and W. D. Thomas 25 Jun. 1964 180 p refs Prepared for JPL *Its* Rept.-8-66348-final
(Contracts NAS7-100; JPL-950693)
(NASA-CR-69579) CFSTI: HC $5.00/MF $1.00 CSCL 09F

A minimum weight, integrated circuit sequence generator was developed as integral part in coded pulse radar systems for the detection of long distance, weak return signals. This integrated sequence generator utilized only solid circuits of semiconductor networks as logic building blocks to generate the long binary codes necessary to increase the rf energy pulse and correlate it over a number of pulses. Reliability test results of over 9000 Series 51 semiconductor networks showed a failure rate of about 6% per 1000 hours for weely-add-to and accelerated testing at 125° C and 200° C; operational field tests produced an 0.018% failure rate per 1000 hours. All test results were obtained on complete circuit semiconductor networks where each network was equivalent to about 20 discrete interconnected components. G.G.

N66-15831# Texas Instruments, Inc., Dallas. Semiconductor-Components Div.
RESEARCH ON OPTOELECTRONIC FUNCTIONAL ELECTRONIC BLOCKS Interim Engineering Report No. 2, 1 Jul.–30 Sep. 1965
J. R. Biard 29 Oct. 1965 38 p refs
(Contract AF 33(615)-2643)
(TI-03-65-111; AD-473357) CSCL 09A

Application of optoelectronics to Functional Electronic Blocks (FEB's) is being investigated to perform functions requiring integrated arrays of solid-state light sources optically coupled to arrays of detector circuits. Task I concerns design and fabrication of optoelectronic FEB's; Task II supports Task I through optical and electrical investigations and experiments required to provide necessary technology and design data. Task I–A commutator array and a read-only memory array have been selected for study. Processing techniques were developed which resulted in the successful fabrication of the commutator light source array. Detector array work has centered on the fabrication of the double-emitter transistors. The initial success with oxide-isolation for the read-only memory light source array has been repeated, and the first measurements were made of quantum efficiency and coupling characteristics. Task II–Material investigations have been conducted with GaAsP and GaP toward improving external quantum efficiency and achieving shorter wavelength emission. Diffusion and transmission experiments have also been conducted. Improvements have been made in the optical microprobe equipment, and a considerable quantity of data has been taken on a variety of samples. The transient behavior of a P-N junction with two-carrier injection has been studied with computer analysis of an electrical analog. Author (TAB)

N66-15862# Hughes Aircraft Co., Fullerton, Calif.
RADIATION EFFECTS ON MICROELECTRONIC CIRCUITS (SEMICONDUCTOR) First Quarterly Report, 1 May–31 Jul. 1965
C. W. Perkins, R. W. Marshall, E. P. Mitchell, and A. M. Liebschutz Nov. 1965 59 p
(Contract DA-28-043-AMC-01313(E))
(FR-65-10-182; ECOM-01313-1; AD-624561) CFSTI: HC $3.00/MF $0.75

The first quarter of the program was devoted entirely to the preparation of devices and instrumentation for the radiation tests. The circuits were procured and subjected to a thorough pre-irradiation test in the laboratory. The report describes the circuits chosen for study and the measurements made in the laboratory bench tests. All of the instrumentation to be used in this program is described in detail in this report. This includes the instrumentation for (1) the laboratory bench tests, (2) the Linac transient radiation effects tests, and (3) the pulsed reactor permanent damage tests. Author (TAB)

N66-15892# General Dynamics/Convair, San Diego, Calif. Space Science Lab.
GAS-SURFACE INTERACTIONS Annual Report, 15 Oct. 1964–14 Oct. 1965
D. Mc Keown, M. G. Fox, H. R. Poppa, and J. Kay Oct. 1965 56 p refs
(Contract Nonr-3157(00))
(GD/C-DBE-65-025; AD-623980) CFSTI: HC $3.00/MF $0.50

A method has been developed for measuring the transfer of energy from a molecular beam to a surface. The method makes use of temperature sensitive y-cut quartz crystals. A crystal was placed in the beam and the energy transferred to its plating was determined by changes in its oscillating frequency. Crystals having a fundamental frequency of 10 mc/sec were used and an energy transfer rate of 50 microwatts could be detected. Probe for measuring energy transfer between a satellite and the upper atmosphere, by D. McKeown, M. G. Fox, and J. Kay; a probe has been developed to measure energy transfer between a satellite surface and the upper atmosphere. Energy transfer is detected by the frequency change of a temperature-sensitive quartz crystal located in the nose of the probe. Transfer rates down to 15 micro W/50 cm can be measured. Data provided by the probe can be used to determine the accommodation coefficients of surfaces, and periodic variations

in the atmospheric density. Results of a satellite flight show that the probe will operate at altitudes up to 500 km where the atmospheric-density is still great enough to produce measurable heating. TAB

N66-15900# Hydraulic Research and Mfg. Co., Burbank, Calif.
PARALLEL BINARY TORQUER FEASIBILITY STUDY
D. S. Seidal China Lake, Calif., Naval Ordnance Test Station, Nov. 1965 98 p
(Contract N123(60530)52063A)
(NAVWEPS-8805; NOTS-TP-3913; AD-623961) CFSTI: HC $3.00/MF $0.75

This document is a facsimile of a report describing a "parallel binary torquer" feasibility study conducted at HR and M under contract no. N-123(60530)52063A. This "parallel binary torquer" is a 'D/A' mechanization intended for application in an electro-hydraulic servo valve. The 'D/A' mechanization which converts a parallel binary work into a proportional analog torque is accomplished by mechanically summing binary weighted torque levels. The binary weighted torque levels are derived from individual solenoids operated in full magnetic saturation. The mechanical summation is the result of utilizing a common (single) armature assembly for all solenoids. Feasibility of this 'D/A' mechanization was demonstrated by constructing and evaluating a ±3 bit parallel binary torquer breadboard driving standard Hydraulic Research and Manufacturing hydraulic preamplifier and power stages. Recommendations are made for a follow-on program continuing the Research and Development (R and D) effort initiated under this feasibility study. The follow-on Research and Development program, as recommended, would utilize the design and developmental techniques formulated during the feasibility study and would result in a ±7 bit parallel binary servo valve experimental model. Author

N66-15901# Sperry Rand Corp., Blue Bell, Pa. Univac Div.
INVESTIGATION OF FAULT DIAGNOSIS BY COMPUTATIONAL METHODS FOR MICROCIRCUITS Final Report, 20 Oct. 1964–19 Nov. 1965
L. Mah, L. Buchsbaum, and T. J. B. Hannom Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Nov. 1965 253 p ref
(Contract AF 33(615)-2094)
(AFAPL-TR-65-111; AD-623957) CFSTI: HC $6.00/MF $1.25

This report describes the computational techniques formulated to extend the methods of automatically isolating faults in electronic circuitry to the level of a micromodule, the micromodule may consist of a single component or it may itself be a microcircuit consisting of several active and passive components. The techniques developed are oriented toward analog circuits. All circuit equations used in the diagnosis are generated by a digital computer from the specification of the circuit schematic in coded form, and from the nominal values and tolerances of all circuit components. Three (3) diagnostic techniques are implemented. Two of the techniques presented utilize a digital computer to implement the diagnosis, whereas the third technique utilizes precomputed network measurement bands and a manual graphic method for fault diagnosis. Author

N66-15908# United Kingdom Atomic Energy Authority, Harwell (England). Solid State Physics Div.
PULSE SHAPE DISCRIMINATORS FOR SCINTILLATORS CONTAINING ZnS(Ag)
L. A. Wraight Aug. 1965 23 p refs
(AERE-M-833) HMSO: 3s 6d

Pulse shapes in ZnS(Ag) for alpha and electron excitation are observed and found to be different. The nature of the short electron pulses is investigated. On the basis of the observations, efficient pulse shape discriminators are devised, and tests with them are reported in this paper. Author

N66-15946# Advanced Technology Corp., Timonium, Md.
DIODE, MILLIMETER WAVE TYPE MIXER (3.2 MM) Seventh Quarterly Report, 1 Dec. 1964–28 Feb. 1965
R. J. Bauer 31 Mar. 1965 26 p
(Contract DA-36-039-AMC-02347(E))
(Rept.-7; AD-624512) CFSTI: HC $2.00/MF $0.50

A step by step fabrication procedure for the developmental models is described, starting with the preparation of the gallium arsenide semiconductor chips. This is followed by the procedure for mounting the gallium arsenide chips to the center conductor of the coaxial IF output. The diode's welded junction forming technique is next described. When an electrically good 94 GHz mixer diode is obtained, the integral waveguide diode mount is then hermetically sealed in dry nitrogen using mica windows. The test setups and procedures for making all of the electrical measurements are described. These measurements include the transducer loss, conversion loss, RF VSWR, IF VSWR, LO power, bias voltage and current, and finally crystal noise ratio (including the local oscillator noise contribution). The actual fabrication of the 53 developmental mixer diodes is approximately 70 percent complete at the end of the report period. Author (TAB)

N66-16007# Tokyo Univ. (Japan). Institute of Industrial Science.
STUDIES ON ELECTRON BEAM NOISE
Yoichi Fujii Aug. 1965 83 p refs *Its* Vol. 14, No. 4 (Serial No. 98) CFSTI: HC $3.00/MF $0.75

This paper concerns with measurements of microwave noise characteristics of an electron beam, and consists of the following two parts; Part One: measurement of electron-beam-noise parameters of a glass sealed-off traveling-wave tube, and Part Two: measurement of a shot-noise reduction factor of the potential minimum on a cathode by applying photodetection techniques to the thermionic cathode. Part One describes measurement of two basic noise parameters, which are conventionally denoted by S and Π, of an electron beam of a glass-sealed traveling-wave tube by using selective beam coupler originally developed by Saito. Difficulties associated with measurement of S and Π of an electron beam in a demountable vacuum vessel are eliminated in the present measurement. Necessary considerations on the measurement of sealed-off tubes and measured results of S and Π are described. The results agree qualitatively with those measured in a demountable vessel by Saito and Zacharias ***et al.*** in general. An abnormal increase of negative Π of a temperature limited cathode is found and analysed in the present report. The measured results also show that the second anode does not behave as a linear element in an electron beam transformation. Conditions to obtain a low noise-figure from these tubes are discussed. Part Two describes a principle and an experiment on shot-noise reduction factor in microwave frequencies. A photodetection of laser techniques is applied. A.c. photocurrent at thermionic cathode by photoelectric effect is considered as a probe to measure the shot-noise reduction. The reduction of the photodetected output is assumed to be a shot-noise reduction factor. A ruby laser is used as a light source and beat frequencies between axial modes of the laser oscillation are detected. Author

N66-16021# Hewlett-Packard Co., Palo Alto, Calif.
MICROWAVE POWER MEASUREMENT
Oct. 1965 90 p refs
(HP-AN64)

Instruments and techniques used for microwave power measurements are described. Various types of bolometers, peak power meters, and calorimetric power meters are discussed in detail. General precautions that should be observed when making microwave power measurements are summarized. Practical techniques for measuring average power and peak pulse power are examined. Calibration services available at the NBS and HP standards laboratories are reported. Methods for improving accuracy are suggested. A section is also included on power level control. M.R.W.

N66-16052*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA, ELECTRON, AND PROTON RADIATION EXPOSURES OF P-CHANNEL, ENHANCEMENT, METAL OXIDE SEMICONDUCTOR, FIELD EFFECT TRANSISTORS
Harry E. Wannemacher Aug. 1965 50 p refs
(NASA-TM-X-55359; X-716-65-351) CFSTI: HC $2.00/MF $0.50 CSCL 09A

P-channel enhancement MOS insulated gate field effect transistors were irradiated with either Co_{60} gammas, 2 Mev electrons, or 22 Mev protons. These devices experienced significant increase in gate threshold voltage. The devices were biased during exposure. The rate of increase in gate threshold voltage appears to be a function of the amount of bias during exposure. Although transconductance was changed, no significant trend toward either increase or decreasing with radiation dose was apparent. Author

N66-16089*# Westinghouse Electric Corp., Lima, Ohio.
FINAL REPORT FOR A BRUSHLESS D.C. TORQUE MOTOR
W. W. Yates and R. E. Skamfer Washington, NASA, Feb. 1966 153 p refs
(Contract NAS5-3934)
(NASA-CR-374) CFSTI: HC $4.00/MF $1.00 CSCL 09C

This contract covered the development of a brushless dc torque motor having characteristics similar to a conventional permanent magnet torque motor for operation in a vacuum. The approach used in the design utilized a permanent magnet rotor and a 3-phase winding in a stationary armature. Magnetic pickup windings in an auxiliary reluctance switch sensed rotor position. The output of these sensing windings was used to drive transistors which provided power to the armature. The test results indicated very good agreement with calculations except for ripple torque and weight. The motor weighed approximately 10 percent higher than the calculated weight. The ripple torque could be improved considerably in future designs. Author

N66-16094# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
EVALUATION OF SFD-315 MAGNETRON AND SOLID STATE DUPLEXER FOR ASDE-2 Final Report
Woodrow R. Applegate Oct. 1965 56 p refs
(RD-65-122)

Evaluation of an inverted circular electric mode (ICEM) coaxial magnetron and a solid state duplexer was undertaken to determine their suitability as replacements for corresponding components originally incorporated in airport surface detection equipment (ASDE-2). The report describes the SFD-315 magnetron and the solid state duplexer and presents the results of various tests conducted to appraise their performance. The ASDE-2 was equipped with specially modified modulators for tests of the SFD-315 magnetron. The Solid State Duplexer was operated in an unmodified channel of the radar and performed satisfactorily throughout a life-test period of 2500 hours. It was concluded that satisfactory system performance can not be achieved using the modified modulators provided for operation of the SFD-315 magnetron; however, the SFD-315 magnetron is suitable for ASDE-2 applications with a compatible modulator, and may be expected to operate satisfactorily for more than 5000 hours. It was also concluded that the solid state duplexer is a suitable replacement for the original duplexer of ASDE-2. Author

N66-16101# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
HIGH SPEED SEMICONDUCTOR SWITCH (TWO TERMINAL) AND HIGH SPEED SEMICONDUCTOR SWITCH (GATE) Ninth Quarterly Report, 29 May–29 Aug. 1965
B. G. Burlingame 28 Aug. 1965 19 p
(Contract DA-36-039-AMC-01475(E))
(QR-9; AD-624153) CFSTI: HC $1.00/MF $0.50

Results are given that were obtained from the use of higher gold diffusion temperatures and a decrease in starting material resistivity, as well as a change in geometry of the three-terminal die. Changes in measurement techniques and conditions are discussed. Summaries of device characteristics are also tabulated. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N66-15585*# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
REDUNDANCY TECHNIQUES TO IMPROVE THE RELIABILITY OF TWO LEVEL AND THREE LEVEL LOGIC CIRCUITS
Kasivisvanathan Vairavan (M.S. Thesis) Jun. 1965 76 p refs (Grant NsG-645)
(NASA-CR-69428) CFSTI: HC $3.00/MF $0.75 CSCL 09C

An investigation was made of some of the important redundancy techniques, and several additional concepts are presented. Two and three level logics are considered, with applications of some briefly indicated. It is shown that hardware redundancy is effective when permanent failures occur; but may not be as effective where noise interference is present. When there is temporary circuit failure, hardware redundancy may not be necessary; a simple repetition of information may be sufficient. Where there is a noise interference, it is likely that all redundant systems are affected. When a permanent circuit failure occurs, information redundancy is useless. When errors are committed, they are repeated, and in such a case hardware redundancy appears to be the only solution. If the system is to be protected against permanent and temporary failures as well as noise, both hardware and information redundancies may be used. C.T.C.

N66-15821*# Honeywell, Inc., St. Paul, Minn. Research Dept.
OPTIMAL STABILIZATION OF NONLINEAR DYNAMICAL SYSTEMS

D. L. Lukes Oct. 1965 25 p refs *Its* Rept.-1546-FTR-3 (Contract NAS8-5222)
(NASA-CR-69573) CFSTI: HC $1.00/MF $0.50 CSCL 09C

A mathamatical formulation of a problem of optimizing nonlinear closed-loop dynamical control systems is presented. It is shown that an integral performance functional induces a partial ordering of the closed-loop controls which stabilize the system. Definitions of minimal and optimal controls are made. It is proved that for certain conditions on the nonlinearities in the equation of the system any minimal control is optimal and a technique is presented for constructing a minimal control. Thus the existence and construction of optimal closed-loop controls for many systems has been established. Author

N66-15835# Harvard Univ., Cambridge, Mass. Cruft Lab.
STABILITY OF A CLASS OF DISCRETE TIME SYSTEMS WITH A SINGLE FEEDBACK NONLINEARITY Interim Technical Report
Kumpati S. Narendra and Charles P. Neuman 1 Jun. 1965 43 p refs
(Contract Nonr-1866(16)
(TR-473; AD-473590)

In this report, the new Lyapunov function introduced recently by the authors is used in order to derive sufficient conditions for the absolute stability of the sampled-data control system which is composed of a linear time-invariant plant characterized by the transfer function in the forward path and a nonlinear feedback element whose argument is a linear combination of the system state variables. The main contribution of this report is the derivation of frequency domain stability criteria for the linear plant in the case of continuous monotone increasing and odd monotone increasing nonlinear feedback functions which have a continuous and bounded derivative and satisfy certain inequality statements. These frequency domain stability criteria provide a direct, systematic method for the generation of explicit Lyapunov functions. In addition, for the case of certain nonlinear time-varying feedback elements, the Lyapunov function is employed to derive a geometrical method, completely analogous to the Circle Criterion of continuous-time dynamical systems, for determining the range of absolute stability of the sampled-data control system through the examination of the frequency response of the time-invariant plant. Author (TAB)

N66-15838# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
REPORT OF THE MEETING OF THE FLIGHT MECHANICS AND FLIGHT STABILIZATION, FLIGHT CONTROL SCIENTIFIC COMMITTEE ON 19 JULY 1963 IN BRUNSWICK [BERICHT UBER DIE SITZUNG DER FACHAUSSCHUSSE FLUGMECHANIK UND FLUGREGELUNG FLUGFUHRUNG AM 19. JULI IN BRAUNSCHWEIG]
K. H. Doetsch and H. Fingado 11 Jan. 1965 105 p In GERMAN and ENGLISH
(DLR-Mitt-65-02) CFSTI: HC $4.00/MF $0.75

Subjects presented at the conference are as follows: *Reliability of VTOL Aircraft Flight Control*; *Possibilities for the Improvement of the Reliability of Flight Control*; *Principles of Fault Analysis Applicable to a Flight Control System*; *Design for and Realization of Flight Control Reliability*; *Principles for Increasing Flight Control Reliability*; *The Achievement of Reliability in VTOL Autocontrol Systems*; and *Automatic Control of VTOL Aircraft*. Transl. by E.E.B.

N66-15943# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ADAPTIVE TECHNIQUE FOR ON-LINE STEADY-STATE OPTIMIZING CONTROL
James H. Burghart (Ph.D. Thesis—Case Inst. of Tech.) Nov. 1965 173 p refs
(AFIT-TR-65-13; AD-624157) CFSTI: HC $5.00/MF $1.00

An adaptive technique is developed for on-line steady state optimizing control. The technique uses an approximate on-line control algorithm with adjustable parameters which are adapted to maximize expected system performance. The technique is applicable to the general multivariable, nonlinear system. Convergence conditions for the adaptation technique are derived. Statistical techniques are applied to the problem of predicting the statistics of the system disturbance inputs which are generally nonstationary. Two approximate methods of implementing this technique are developed to ease the computational burden. The factors involved in designing a control system using this technique are discussed from the point of view of trying to maximize an overall system profit function; the function includes the cost of control. TAB

N66-16022# Industrial Science and Technology Agency, Tokyo (Japan).
OPTIMAL CONTROL OF GENERALIZED PROCESSES
Saburo Tsuji Dec. 1964 98 p refs In JAPANESE; ENGLISH Summary *Its* Res. of the Electrotech. Lab. No. 655 CFSTI: HC $3.00/MF $0.75

A method for the optimal control of generalized processes is studied. Discontinuous cost functions are maximized for the process which has many dead time elements, and the results are applied to many typical continuous processes and sampling systems. The conditions of corner points or singular points are calculated, and the strategies of manipulated variables are decided by the characteristics of stationary curves which are the solutions of Euler equation. Analysis based on Euler equation (and also Pontriagin's Maximum Principle) requires to solve a two-point boundary value problem of simultaneous nonlinear difference-differential equations, which is very difficult for general processes. Several methods of approximation are proposed for this reason, and the errors of search methods are formulated. Necessary conditions for the optimality of the sampled data control system are formulated. Discussions on the steepest descent method in a Hilbert Space give a method of successive approximation of the optimal control under the generalized restricting conditions. M.R.W.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N66-15218# Naval Radiological Defense Lab., San Francisco, Calif.
A LABORATORY APPARATUS FOR MEASURING THE AMOUNT OF TRITIUM ACTIVITY REMOVED FROM A CONTAMINATED SURFACE, BY DIRECT CONTACT WITH THE SURFACE

William R. Balkwell and Don A. Kubose 30 Sep. 1965 31 p refs
(USNRDL-TR-913; AD-624202) CFSTI: HC $2.00/MF $0.50

The sampling component is a small glass roller wrapped with a strip of filter paper dampened with ethylene glycol. It is rolled over the contaminated surface to sample the activity. After a run, the contaminated roller is dropped immediately after contact with the surface into a counting vial containing a scintillant solution, and the activity is assayed. The apparatus is small enough to be operated in a conventional glove box. The precision of the measurements is influenced by the texture of the surface sampled. Precision measured on a smooth optical quartz surface using a nonvolatile tracer, Pm^{243}, as a contaminant, was determined to be ±2%. The precision for tritium sampling from a relatively coarser, nonuniform metal surface was approximately ±25%. The apparatus can be used to study the rate of tritium desorbed from the surface, which allows estimation of the cumulative hazard effect of multiple contacts with the surface during the desorption period. Representative samples of metal surfaces exposed to tritium show that after exposure, desorption is exponential, decreasing to an 'equilibrium' amount within a few hours. Multiple contracts with these desorbing surfaces did not seem to significantly alter the desorption process. Author (TAB)

N66-15233*# General Applied Science Labs., Inc., Westbury, N. Y.
PRELIMINARY DESIGN AND TEST OF HIGH ENTHALPY DEVICE
Ira Nathan, Martin Novack, and Manuel Recarey [1964] 119 p refs
(Contract NAS1-3909)
(NASA-CR-66015) CFSTI: HC $4.00/MF $0.75 CSCL 14B

A study has been made of the feasibility of adding kinetic energy to the supersonic exhaust of a shock tunnel by reversing the flow direction with a high speed piston. A critical element of the concept, the 180° turning passage, has been studied experimentally to determine the quality of the flow and pressure recovery of the reversed stream. A scheme of the overall facility design is presented with approaches to individual problem areas indicated. Author

N66-15311# School of Aerospace Medicine, Brooks AFB, Tex.
THE SAM HIGH LEVEL COBALT-60 IRRADIATION FACILITY
Kenneth A. Hardy, H. A. W. Spetzler, and Roger W. Cochran Sep. 1965 14 p refs
(SAM-TR-65-65; AD-473978)

In January 1960, a 12,400 curie cobalt-60 facility was installed at the USAF School of Aerospace Medicine. It was primarily designed to provide uniform fields at high dose rates for the whole-body exposure of large animals, such as primates, and other objects of comparable size. The cobalt-60 sources were arrayed about a horseshoe-shaped holder in such a manner that the holder could be treated mathematically upon calibration as a point source. The calibration was accomplished with both passive and active dosimetry systems and included comparison with other cobalt-60 facilities. Given are the physical dimensions and arrangement of the facility, the exposure geometry, the equations utilized to determine the dose rate, the compensations necessary for source decay, and the isodose limits. Author (TAB)

N66-15341*# Northrop Space Labs., Huntsville, Ala. Space Systems Section.
DESIGN AND ANALYSIS OF UNLOADING AND TIE-DOWN SYSTEMS. APOLLO LOGISTICS SUPPORT SYSTEMS MOLAB STUDIES Technical Report, 1 Oct.–7 Dec. 1964
Jerome E. Ligocki and Glenn J. Youngblood Dec. 1964 115 p refs
(Contract NAS8-11096)
(NASA-CR-61048) CFSTI: HC $4.00/MF $0.75 CSCL 22D

Systems were developed for unloading two lunar surface mobile laboratory (MOLAB) configurations from the LEM truck (LEM/T) to the lunar surface. The MOLAB configurations used were a four wheel and a six wheel semiarticulated vehicle. Preferred unloading systems and alternates having varying degrees of azimuth capability were developed for each of the two vehicles. The azimuth capabilities considered were: (1) single fixed direction, (2) two directions (180° apart), (3) ±45° from the vehicles longitudinal centerline and (4) 0–360° multiazimuth. Weights of each of the unloading systems are given. In addition, structural systems for securing the MOLAB vehicles to the LEM/T from launch to lunar landing were developed. The weights of these systems are also given. Author

N66-15368*# Aerojet-General Corp., Covina, Calif. Aetron Div.
ECONOMIC ANALYSIS OF PERLITE VERSUS SUPER INSULATION IN LIQUID HYDROGEN STORAGE AND RUN VESSELS FOR THE M-1 PROGRAM
J. C. Commander and L. L. Rotter 15 Oct. 1965 33 p refs
(Contract NAS3-2555)
(NASA-CR-54720; AGC-8800-13) CFSTI: HC $2.00/MF $0.50 CSCL 14A

This report is an evaluation, on a cost comparison basis, of the economic aspects of two possible insulation systems, powder type (Perlite) and multilayer aluminum foil reflective type (Quilted Super Insulation). The analysis applies to 370000 and 575000 gallon liquid hydrogen storage dewars rated at 50 and 100 psig designed for the M-1 Engine Program. Author

N66-15466# Laboratoire d'Aerothermique du C.N.R.S., Bellevue (France).
SYSTEMATIC STUDY OF THE EFFECT OF THE COOLING OF THE LINING IN THE PERFORMANCES OF A WIND TUNNEL NOZZLE AT LOW DENSITY [ETUDE SYSTEMATIQUE DE L'EFFET DU REFROIDISSEMENT DE PAROI SUR LES PERFORMANCES D'UNE TUYERE DE SOUFFLERIE A BASSE DENSITE]
Philippe Seurin Oct. 1964 46 p refs In FRENCH
(Rept.-65-8) CFSTI: HC $2.00/MF $0.50 CSCL 14B

An investigation is made to determine if a cooled wind tunnel nozzle of simple construction will give better performance than a noncooled nozzle. About the same results are obtained with both as long as the uncooled nozzle has approximately the same lining temperature as would be calculated theoretically. Hypothesis, methods, and results of calculations are discussed; and experimental findings are presented, and numerous graphs and tables are included. Also considered are cases where the lining temperature is other than that obtained from theoretical calculations. Transl. by M.W.R.

N66-15475# Oxford Univ. (England). Engineering Lab.
THE STARTING PROCESS IN A HYPERSONIC NOZZLE
C. Edward Smith, Jr. Jul. 1965 34 p refs Sponsored in part by NATO
(Rept.-1000) CFSTI: HC $2.00/MF $0.50

This paper describes an experimental study of the starting process in a reflected-shock tunnel, and compares the results with numerical calculations. It is shown that an unsteady expansion wave dominates the transient flow, and the shock-wave system plays a minor role. The effects of initial pressure in the nozzle were investigated, and the behavior of the secondary shock wave was noted. It was found that initial pressures larger even than the steady-flow static pressure can be tolerated without prolonging the starting process, despite the presence of a strong secondary shock wave. Other analyses, based on the "steady-state" model of the starting process, are discussed and shown to give an unrealistic description of the flow field. Author

N66-15476*# General Motors Corp., Santa Barbara, Calif. GM Defense Research Labs.
SURVEYOR LUNAR ROVING VEHICLE, PHASE I. VOLUME II: APPENDIXES. SECTION II: ELECTRONIC SUBSYSTEMS Final Report
23 Apr. 1964 427 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950657)
(NASA-CR-69396; TR-64-26, Vol. II, Section II) CFSTI: HC $7.27/MF $2.25 CSCL 22D

The electronic subsystems for the operation ground equipment, communications, power supply, telemetry, command and control, television subsystems and the systems engineering for the Surveyor lunar roving vehicle are contained in this volume of the final report. An analysis of the electromagnetic propagation between the Surveyor bus and the Surveyor lunar roving vehicle; an analysis of direct Surveyor lunar roving vehicle (SLRV) to earth and earth to SLRV communications links; modulation and demodulation investigations; ranging and bearing investigations and error analyses; antenna investigation; physical characteristics of S-band and VHF communications configurations; and VHF earth–SLRV–earth backup considerations are presented for the communications subsystem. The section on power supply subsystem summarizes the detailed analyses which were used to arrive at conclusions and preliminary designs for this subsystem. The telemetry data requirements for the SLRV are tabulated. E.E.B.

N66-15477*# Bendix Corp., Ann Arbor, Mich. Bendix Systems Div.
SURVEYOR LUNAR ROVING VEHICLE, PHASE I. VOLUME IV: RELIABILITY Final Report
Apr. 1964 420 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950656)
(NASA-CR-69397; BSR-903, Vol. IV) CFSTI: HC $7.20/MF $2.00 CSCL 22D

This volume of the five volume final technical report presents the results of the Surveyor lunar roving vehicle, Phase I study and summarizes the reliability efforts and results of updating and completion of system and subsystem reliability in the areas of goals, predictions, block diagrams, mathematical models, analysis of failure modes, and criticality rankings of failure modes. Also, the effect of degraded modes of operation on system reliability are discussed. E.E.B.

N66-15481*# General Motors Corp., Santa Barbara, Calif. GM Defense Research Labs.
SURVEYOR LUNAR ROVING VEHICLE, PHASE I. VOLUME II: APPENDIXES. SECTION IV: RELIABILITY Final Report
23 Apr. 1964 163 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950657)
(NASA-CR-69399; TR-64-26, Vol. II, Section IV) CFSTI: HC $5.00/MF $1.00 CSCL 22D

The trade-off studies performed as part of the primary reliability activity of the Phase I Surveyor lunar roving vehicle are presented. Detailed predictions of successful mission accomplishment were also generated for the selected system configuration. Also, the failure modes were identified for all subsystems of the flight hardware. Reliability goals, compromised mission capability, and the survey of available data and experience for the purpose of generating parts and materials lists applicable to the lunar roving vehicle mission and environments are included. E.E.B.

N66-15482*# General Motors Corp., Santa Barbara, Calif. GM Defense Research Labs.
SURVEYOR LUNAR ROVING VEHICLE, PHASE I. VOLUME II: APPENDIXES. SECTION V: ADDITIONAL INFORMATION ON RTE Final Report
23 Apr. 1964 30 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950657)
(NASA-CR-69398; TR-64-26, Vol. II, Section V) CFSTI: HC $2.00/MF $0.50 CSCL 22D

Additional information is presented on the electronics subsystems and the power supply subsystem for the Surveyor lunar roving vehicle. Changes include new weight values for the lead telluride and silicon–germanium thermocouples. Characteristics of the power supply subsystem are tabulated and a block diagram for the subsystem is included. Also, the switching regulators and a multitap voltage converter are described. The battery requirements for the power supply subsystem are given. E.E.B.

N66-15483*# Bendix Corp., Ann Arbor, Mich. Bendix Systems Div.
SURVEYOR LUNAR ROVING VEHICLE, PHASE I. VOLUME III: PRELIMINARY DESIGN AND SYSTEM DESCRIPTION. BOOK 2: VALIDATION OF PRELIMINARY DESIGN Final Report
Apr. 1964 373 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950656)
(NASA-CR-69397; BSR-903, Vol. III, Bk. 2) CFSTI: HC $7.00/MF $2.00 CSCL 22D

The validation of the feasibility of the preliminary 100-lb vehicle design is presented and the extent to which it is practical and realistic to implement a 100-lb Surveyor lunar roving vehicle that can satisfy mission objectives is demonstrated. Mobility, structure, deployment, folding and erection mechanisms, and Apollo support scientific experiments are covered in this volume of the five volume final report. E.E.B.

N66-15515# Aerodynamische Versuchsanstalt, Gottingen (West Germany).
REPORT OF ACTIVITIES OF THE AERODYNAMISCHEN VERSUCHSANSTALT, GOTTINGEN, 1964 [TATIGKEITSBERICHT DER AERODYNAMISCHEN VERSUCHSANSTALT GOTTINGEN E. V., 1964]
1965 32 p refs In GERMAN
CFSTI: HC $2.00/MF $0.50

Activities during the year 1964 centered on the following studies: (1) *Aerodynamics*—laminar two-flow boundary layers, turbulent boundary layers, eddy formation, lift, hypervelocity flows, and wind tunnel measurements; (2) *Gas Dynamics*—calibrations in transonic wind tunnel, studies on delta wings, stability of spiral flows, etc.; and (3) *Aeroelasticity*—aerodynamics of vibrating bodies, and vibration calculations. Included is a brief review of the institute's overall organization and its instrumentation. Transl. by G.G.

N66-15544# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
SOUND MEASUREMENTS OF THE ARMED PERSONNEL CARRIER M-113 A1 [GELUIDMETINGEN TROEPEN-TRANSPORTVOERTUIG M-113 A1]
R. Plomp and A. M. Mimpen Aug. 1965 11 p In DUTCH; ENGLISH summary
(IZF-1965-17; TDCK-43439)

Results of sound measurements in the American armed personnel carrier M-113 A1 are communicated. The ISO proposals on noise limits in view of hearing losses were exceeded in all cases, so ear protection must be prescribed for the crew. Author

N66-15590*# TRW Systems, Redondo Beach, Calif. Space Physics Lab.
BALLOON EXPERIMENTS WITH THE STL FLIGHT PROTOTYPE LUMINESCENT CHAMBER Final Technical Report
R. F. Doolittle 1 Nov. 1965 48 p
(Contract NASw-743)
(NASA-CR-69438; STL-4141-6004-RU-000) CFSTI: HC $2.00/MF $0.50 CSCL 14B

The development of the flight prototype luminescent chamber to obtain a visual record of the track produced by a charged particle traversing a scintillation crystal is reviewed, as well as the selection of a balloon experiment to test the chamber for future space physics investigations. Described in detail are the track forming scintillator and counter assembly, the flight film magazine, the electronics design for pulse height analysis, calibration procedures, and the mechanical assembly. Following the completion of electrical and mechanical tests, the equipment was launched. An automatic timer had been set to release the balloon; however, a radio signal was received indicating that the recording film had been expended, and the flight was terminated. Post-failure analysis and inspection of the silver cell battery pack after recovery indicated that the entire battery pack, including the bad cells, had been very poorly formed. The abnormalities of the cells that failed during the flight are summarized. R.R.D.

N66-15595*# TRW Systems, Redondo Beach, Calif. Physical Electronics Lab.
HIGH-REPETITION-RATE PARTICLE INJECTOR FOR ELECTROSTATIC ACCELERATOR
D. G. Becker Jul. 1965 10 p
(Contract NASw-936)
(NASA-CR-69445; STL-4158-6014-TU-000) CFSTI: HC $1.00/MF $0.50 CSCL 20G

The development of an utomatic particle injection system is described, which is capable of simulating long-term micrometeoroid bombardment on the two-million-volt accelerator. The charged particle injector requires the application of a large negative voltage pulse in order to inject particles into the accelerator, and the number of particles injected per pulse is a function of pulse amplitude and duration, which are normally adjusted so that the average rate is about one particle per pulse. The results indicate that the injector was operated under these conditions at the rate of 10 particles per second for periods of over 100 hours with no noticeable deterioration in performance. R.R.D.

N66-15596*# TRW Systems, Redondo Beach, Calif. Physical Electronics Lab.
ELECTRONIC PARTICLE-PARAMETER ANALYZING SYSTEM FOR AN ELECTROSTATIC HYPERVELOCITY PROJECTOR
D. O. Hansen Jul. 1965 16 p refs
(Contract NASw-936)
(NASA-CR-69446; STL-4158-6016-TU-000) CFSTI: HC $1.00/MF $0.50 CSCL 20G

The development of an automatic particle parameter analyzing system is described. The main component of this system is an electronic X-Y plotter, with each particle represented by a point on a two-dimensional display. The displacement of the point along the Y axis is proportional to the charge on the particle, and the displacement in the X direction is proportional to its transit time through the detector. Since each particle is represented by a single point, rather than by a rectangular pulse as in the former method, a large number of data points can be placed on a single display before confusion arises. Further, lines of equal radius and velocity can be drawn on the plot and will form a number of irregularly shaped areas, each of which corresponds to a specific velocity and radius range. It is also noted that the radius and velocity of each particle can be determined fairly accurately by simply observing into which area the point falls. R.R.D.

N66-15681# India. Dept. of Atomic Energy, Bombay.
VAN de GRAAFF LABORATORY PROGRESS REPORT, 1 JANUARY–31 DECEMBER 1964
T. P. David, comp. 1965 75 p refs
(AEET-214) CFSTI: HC $3.00/MF $0.75

Work of the various groups of the Van de Graaff Laboratory is summarized. Repairs, modifications, and additions to the accelerator are detailed; and reviews are presented for development projects related to beam switching magnets, in electromagnetic quadrupole focusing lens, thermomechanical leak, and the helium ion source. Among the research projects are those dealing with the levels of Titanium 44, nuclear reactions from proton bombardment of Aluminum 27, proton-gamma angular correlation in the Fluorine 19 reaction, a distorted wave Born approximation for ^{3}He,p reactions, and long range alpha particle emission in the fission of Uranium 235 by 3MeV neutrons. Instrumentation experiments include studies of a multiple coincidence system, ion pumps, electron bombardment apparatus for preparation of targets, and an electromagnetic isotope separator. M.W.R.

N66-15753# C. G. S. Scientific Corp., Southampton, Pa.
OPERATION AND MAINTENANCE MANUAL FOR VACUUM AND INBLEED CONTROL SYSTEM, AIR LOCK CONTROL SYSTEM, CHAMBER LINER DIFFERENTIAL PRESSURE CONTROL SYSTEM AND INTERIOR GAS FLOW RECORDING SYSTEM FOR ALTITUDE CHAMBERS Final Report
R. L. Bunley [1965] 19 p refs
(Contract AF 41(609)-2730)
(FR-10/5/65; AD-624587) CFSTI: HC $1.00/MF $0.50

Theory and operation are discussed for the control systems for vacuum and inbleed, air lock, and chamber liner differential pressure; and operation and calibration are considered for the interior gas flow recording system for four altitude research chambers. Details of maintenance procedures can be found in the literature of the equipment suppliers, a listing of these is included. Numerous reference drawings are included. M.W.R.

N66-15772*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
DETERMINATION OF DIAPHRAGM OPENING-TIMES AND USE OF DIAPHRAGM PARTICLE TRAPS IN A HYPERSONIC SHOCK TUBE

J. E. Drewry and Z. A. Walenta Jun. 1965 50 p refs
(Grant NsG-633)
(NASA-CR-69546; UTIAS-TN-90) CFSTI: HC $2.00/MF $0.50 CSCL 14B

As a result of particle impact and erosion which were encountered during the initial calibration tests of the 4 in. × 7 in. combustion-driven shock tube, a limited experimental program has been carried out in order to obtain information that would prove useful in overcoming this problem. The investigation consisted of (1) measurements of the time required for shock tube diaphragms to rupture and (2) an evaluation of shock tube performance when a system of diaphragm particle traps was located just downstream of the diaphragm station. Two simultaneous and independent measurements of diaphragm opening-times were made in order to try to establish a reasonable working value which may be used in some future design of a quick-opening, shock-generating valve to replace shock tube diaphragms. Such a device would greatly enhance shock tube operation. The use of an optically-tight system of traps provides a possible means of removing diaphragm particles from shock tube flows. Such a trap system was designed and tested in the present work, with particular emphasis given to the determination of its effect on the overall performance of the shock tube. Author

N66-15830*# Electro-Optical Systems, Inc., Pasadena, Calif.
HALL CURRENT ACCELERATOR Final Report, 10 Jun. 1964–10 Sep. 1965
G. L. Cann, R. L. Harder, R. A. Moore, and P. D. Lenn. 4 Feb. 1966 158 p refs
(Contract NAS3-5909)
(NASA-CR-54705; EOS-5470-Final) CFSTI: HC $4.00/MF $1.25 CSCL 20G

Experimental and analytical investigations of axisymmetric Hall current accelerators are reported. The purpose of the investigations was to determine the performance potential of such a device as an electric space propulsion engine. Parametric studies of the accelerator were made with several propellants, emphasis being placed upon the tests using hydrogen and sodium. Some diagnostic measurements on the engine and exhaust beam were made and are reported, the most important being a determination of the current path in the exhaust beam of the hydrogen accelerator. Mechanisms to explain thrust production and other engine characteristics are postulated and discussed in detail. The concept of an "effective" mass flow rate, which is determined by a minimum potential hypothesis, is developed to the point where a complete analysis of a simplified model of the accelerator can be made. Such an analysis is completed and the results are compared, where possible, with experimental results. Author

N66-15869# Technisch Documentatie en Informatie Centrum Voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON MILITARY CONSTRUCTION [KRIJGSBOUWKUNDE LITERATUUROVERZICHT]
4 Oct. 1965 23 p refs In DUTCH and ENGLISH *Its* Vol. 7, No. K-77 CFSTI: HC $1.00/MF $0.50

A compilation of abstracts is presented of literature pertaining to military construction. Major areas considered are concrete; ground mechanics and foundation technology; bridges, roads, and airfields; photogrammetry and geodetics; civilian construction; and chemical, biological, and radiological warfare. Building constructions, building physics, and building materials are topics considered under civilian construction; and such areas as shock waves, blasting, and protective buildings are included relative to warfare. C.T.C.

N66-15981*# Illinois Univ., Urbana. Coordinated Science Lab.
THEORETICAL AND EXPERIMENTAL STUDIES OF THE UNDERLYING PROCESSES AND TECHNIQUES OF LOW PRESSURE MEASUREMENT Semiannual Status Report, Sep. 1, 1964–Feb. 28, 1965
F. M. Propst Jul. 1965 48 p refs
(Grant NsG-376)
(NASA-CR-69654) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Progress is reported on the pumping of getter-ion pumps at low pressures; crossed field mass spectrometer of high sensitivity and moderate resolution; secondary emission using high resolution; the angular distribution of electrons and ions leaving a solid surface due to electron and ion impact; and the kinetics of gaseous adsorption and desorption. The evaluation program for the suppressor ionization gauge was completed and the results of this program are presented. Each of the other programs are described. E.E.B.

N66-16025*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE HYPERTHERMAL SUPERSONIC AERODYNAMIC TUNNEL
Howard A. Stine [1963] 30 p refs
(NASA-TM-X-50529) CFSTI: HC $2.00/MF $0.50 CSCL 14B

The behavior of electric-arc-heated hyperthermal wind tunnels is discussed. The fundamental problem is to prevent the walls of the containing vessel from vaporizing since a high enthalpy arc column has a large heat loss from the periphery. One way to reject a minimum of waste heat from the gas is to provide a cylindrical constrictor tube for the arc discharge which serves also as the wind-tunnel throat, the arc being passed completely through the wind-tunnel nozzle. Both theory and experiment agree as to trends of enthalpy with arc current, constrictor radius, gas properties, and mass flow. Estimates of the effects of radiation on performance show that maximum enthalpy achievable at high pressure will be limited by inability to cool the throat sufficiently. Author

N66-16026*# Washington Univ., Seattle. Aeronautical Lab.
AN EXPERIMENTAL INVESTIGATION OF FEASIBILITY OF A V/STOL TEST SECTION IN UWAL 8 × 12 WIND TUNNEL BY USING A 1/8 SCALE MODEL OF THE TUNNEL
Shojiro Shindo and Robert G. Joppa 5 Feb. 1965 48 p refs *Its* Rept.-801
(Grant NGR-48-002-010)
(NASA-CR-69663) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Feasibility of adding a large test section upstream of the 8 × 12 test section of the F. K. Kirsten wind tunnel was experimentally investigated by a scale model of the existing wind tunnel. The validity of the unmodified model was first verified by comparing model tunnel flow with full scale 8 × 12 tunnel flow. Finally, the model tunnel was modified by adding a 21 × 19–60 foot test section upstream of the 8 × 12 test section. Corner vanes and propeller anti-swirl vanes were shown to have sufficient effectiveness to control flow angles and velocity distribution in both test sections. A final adjustment was achieved which gave satisfactory flow in both test sections. It is concluded that the proposed modification of the present 8 × 12 test section wind tunnel to accommodate a large test section for V/STOL aircraft wind tunnel testing is feasible. Author

N66-16043# Bergen Research Engineering Corp., Teterboro, N. J.
DEVELOPMENT OF A LOW COST SECONDARY AIRPORT LIGHTING SYSTEM Final Report

R. G. Ross Sep. 1965 34 p
(Contract FA-WA-4615)
(RD-65-26)

Low capital cost of a lighting system for VFR night operations at secondary airfields can be achieved using a three-fold design approach. This design approach employs pulsed incandescent lamps in place of xenon flash tubes, and substitutes fluorescent lights for steady burning incandescent sources when feasible. In addition, it sizes wind indicators to the legibility needs of typical secondary airport operations. The major components of the lighting system described in this report include runway edge lights, steady burning approach and threshold lights, wind tee, rotating beacon, glide slope indicator, and obstruction lights. A field test of the prototype is recommended to evaluate the operational usefulness of the low cost lighting. Also recommended, is the initiation of a new wind indicator design, based on the minimum resolution of wind speed and direction needed for secondary airport operations. Author

N66-16145*# General Electric Co., Daytona Beach, Fla.
STAGE CHECKOUT PLAN
5 Aug. 1963 121 p revised Prepared for NASA
(NASA-CR-69710) CFSTI: HC $4.00/MF $1.00 CSCL 22D

The philosophy, requirements, documentation, planning, and equipment descriptions for checking out all stages of a launch vehicle are defined. Vendor checkout and receiving inspection procedures necessary for quality assurance are also included, along with guidelines for checkout operations on all stages or on a component part installed on any stage. The plan is oriented to the checkouts necessary before, during, and after assembly; and before and after captive test firing. It is predicated on broad planning for integrating all elements. The assembly phases covered include receiving inspection, fabrication analysis, components checkout, subassembly, and stage analysis. Individual subsystem and system test requirements are established, and overall systems tests are devised with mission requirements and systems synthesis considered. Test equipment and facilities are described; the various charts and schedules that should be included are discussed; and time allocations for completing each milestone are estimated. M.G.J.

N66-16160*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR SIMULATION RESEARCH
Charles H. Duncan, John Flemming, Daniel Gallagher, William Gdula (Taag Designs, Inc.). Danny Lester et al Aug. 1965 185 p refs
(Contract NAS5-2382)
(NASA-TM-X-55364; X-633-65-332) CFSTI: HC $5.00/MF $1.25 CSCL 14B

Research oriented towards improvement of measurement techniques of solar simulators, support equipment, and solar cells resulted in the following measurement accuracy capabilities: 1) spectral irradiance ±10%; 2) total irradiance ±2.5%; 3) uniformity and stability ±0.5%; and 4) spectral response (detectors, solar cells) ±3.0%. The total irradiance, uniformity, stability, collimation, target volume, vaccum, and thermal shroud characteristics ot two solar simulators presently being used, the Spectrolab A-1200 and the Spectrolab X-25L, are also listed. Also reported are efforts towards developing an improved source for solar simulators using an experimental pressure arc chamber and a vortex stabilized radiation source. Preliminary results using argon indicate that an advantage could be obtained by using equal numbers of xenon and argon lamps in a solar simulator in which each lamp illuminates the total volume. L.S.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N66-15201*# Iowa State Univ. of Science and Technology, Ames. Iowa Engineering Experiment Station.
FLUID VELOCITY PROFILE DEVELOPMENT FOR TURBULENT FLOW IN SMOOTH ANNULI
Theodore H. Okiishi (Ph.D. Thesis) Jul. 1965 154 p refs
(Grant NsG-62-60)
(NASA-CR-68501) CFSTI: HC $5.00/MF $1.00 CSCL 20D

Flow development is found to be more repeatable through annuli with square-edged entrances than those with rounded entrances. Velocity profile and pressure gradient data indicate different development patterns for the two types of entrances. It is assumed that in typical annular flows, the flow development is not exactly axisymmetric. In cases where axisymmetric patterns are important, careful assembly of the apparatus will be required. Control of transition by boundary layer tripping would probably result in stable axisymmetric flow development in rounded-entrance annuli. It is shown that pressure gradient, shape factor, and skin friction factor data of two rounded annuli are noticeably affected by transition. A flow visualization study is considered most practical for study of the transition process. M.W.R.

N66-15234# Sperry Rand Research Center, Sudbury, Mass.
A COMPUTATIONAL METHOD FOR TIME-DEPENDENT TWO-DIMENSIONAL INCOMPRESSIBLE VISCOUS FLOW PROBLEMS
Carl E. Pearson Feb. 1964 128 p refs
(SRRC-RR-64-17)

A fourth-order partial differential equation is solved in three variables containing nonlinear terms by a computer program for the analysis of time-dependent two-dimensional viscous flow problems. The developed program permits arbitrary prescriptions of velocities at the boundaries of the region. Most of the experimentation with the computer program has been with a test problem whose exact solution is known; and accuracies have been very good even with time-steps up to 50 times as great as those permitted by conventional stability limitations. The general method has also been applied to two problems whose solutions are not known: one concerns the injection of fluid into a rectangular region, the other is a time-dependent version of a Karman disk problem; and results are presented for the former. Background data on numerical analysis are presented in some detail, and deal with finite Fourier series, stability of the diffusion equation, optimal over-relaxation, truncation error, and various methods. A logic flow chart and Fortran listing of a typical experimental program is included; and the Fortran listing is given for the fluid injection program. M.W.R.

N66-15361*# Southwest Research Inst., San Antonio, Tex.
SOME STUDIES OF NONLINEAR LATERAL SLOSHING IN RIGID CONTAINERS
H. Norman Abramson, Wen-Hwa Chu, and Daniel D. Kana Washington, NASA, Jan. 1966 41 p refs
(Contract NASr-94(03))
(NASA-CR-375) CFSTI: HC $2.00/MF $0.50 CSCL 20D

Some experimental data, primarily on total force response, are presented for nonlinear lateral sloshing in rigid tanks of various geometries. Some effect of excitation amplitude on liquid swirl boundaries in an open circular cylindrical tank is noted. Data for the circular cylindrical tank is also compared with theoretical predictions. The primary nonlinear effects observed in all tanks were decreasing response frequency with increasing excitation amplitude and jump phenomena. Author

N66-15363*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF FREE-MOLECULE FLOW WITH SURFACE DIFFUSION THROUGH CYLINDRICAL TUBES

Thaine W. Reynolds and Edward A. Richley Washington, NASA, Jan. 1966 44 p refs

(NASA-TN-D-3225) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The integrodifferential equation governing flow through cylindrical tubes under combined free-molecule gas flow and surface diffusion has been solved numerically for tube length-to-radius ratios of 1/16, 1/8, 1, 4, and 16 and for a wide range of flow parameters. Several transmission probability relations are developed that permit various comparisons of flow with and without surface diffusion for given tube length-to-radius ratios. General results are tabulated for inlet and outlet surface coverage fractions, gradients in surface coverage fraction, and transmission factors. Specific solutions for tube flows matched to inlet and outlet surface flows are given. Results are presented for the single tube solutions only, but relations are given by which these results can be applied to models of porous media as well. In the matched solutions, the total transmission factor increased with increasing values of the surface diffusion parameter. The solutions are shown to be asymptotic to the long tube approximations. Results are compared with those of other investigators and differences are found to be primarily due to variations in basic assumptions with respect to the model. Author

N66-15473# Aerodynamische Versuchsanstalt, Gottingen, (West Germany).

TURBULENT BOUNDARY LAYERS WITH BLOWING OUT OF COLD AND WARM AIR THROUGH PERFORATED AND SLOTTED WALLS [TURBULENTE GRENZSCHICHTEN MIT AUSBLASEN VON KALTER UND WARMER LUFT DURCH EINE GELOCHTE ODER GESCHLITZTE WAND]

W. Wuest Mar. 1965 48 p refs In GERMAN; ENGLISH and FRENCH summaries

(DLR-FB-65-13; AVA-FB-65-03) CFSTI: HC $2.00/MF $0.50

The development of turbulent boundary layers was investigated with blowing out of cold and hot air for different porous walls, among which a plane wall made from Perflec material, a wall with transverse slits and a cylinder with rows of holes. In all cases velocity and temperature profiles were measured. In the case of the Perflec-wall with uniformly distributed porosity the shear stress was calculated from the momentum equation and compared with a universal law. Author

N66-15537# General Applied Science Labs., Inc., Westbury, N. Y.

MEASUREMENTS OF THE TURBULENT NEAR WAKE OF A CONE AT MACH 6

A. Martellucci, H. Trucco, and A. Agnone Dec. 1964 85 p refs

(Contract ARPA SD-149; ARPA Order 396)

(GASL-TR-482; AD-456869)

Flow properties in the subsonic and supersonic regions of the turbulent near wake of a 10-degree half angle circular cone at zero angle of attack in a Mach 6 flow were measured. Tests were conducted at a stagnation pressure of 800 psia with a corresponding Reynolds number of 14.4×10^6 ft. The boundary layer flow on the cone surface was turbulent for the entire test series. To optimize the method of support for a minimum of flow interference, several model support schemes were investigated. The system that provided a minimum of support interference consists of a slender axial sting attached to the model nose and also extended upstream through the nozzle throat. The model was supported at the base by three bands 0.010-in. thick and 0.250-in. wide, with a 60-degree sweep back. The total temperature, total, and static pressure distributions in the supersonic part of the wake were recorded at various axial stations and radial distances from the model axis. The radial base pressure distribution, the u=o line; that is, the locus of all points in the recirculation zone where there is only a component of velocity normal to the cone axis, the pitot and static pressures on the model axis in the subsonic region, and various properties in the recirculation zone are presented. Some effects of support interference on the wake properties are also presented. Author (TAB)

N66-15547# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany).

REPORT ON THE COMPUTER CENTER OF THE GERMAN AIR AND SPACE FLIGHT INSTITUTE FOR THE YEAR 1964 [BERICHT UBER DAS RECHENZENTRUM DER DEUTSCHEN FORSCHUNGSANSTALT FUR LUFT- UND RAUMFAHRT FUR DAS JANR 1964]

R. Ludwig 1 Jun. 1965 41 p refs In GERMAN; ENGLISH and FRENCH summaries

(DLR-65-05) CFSTI: HC $2.00/MF $0.50

An annotated review of computer calculation activities during the year 1964 is presented. A variety of problems pertaining to aerodynamics, airplane construction, airplane control, airplane mechanics, and jet propulsion were studied. Computer utilization during night time increased the overall number of computations considerably. Transl. by G.G.

N66-15553# Atomic Energy Establishment, Winfrith (England). Reactor Development Div.

THE STABILITY OF LAMINAR FLOW OF A LIQUID BETWEEN PARALLEL PLANES

P. G. Barnett Jan. 1965 37 p refs

(AEEW-R-416)

The stability of laminar flow of an incompressible viscous liquid moving between two fixed parallel planes when the laminar motion is subjected to a particular kind of infinitesimally small disturbance is examined. A new numerical method has been developed for solving the resulting eigenvalue problem; this method has been used to obtain some seventy results. These results enable the curve of neutral stability to be plotted accurately. They have also been compared with results from two other sources. The magnitudes of the various forms of instability which arise suggest that infinitesimally small disturbances of the type considered are unlikely to provide a complete explanation of the transition from laminar to turbulent flow. Author

N66-15574# National Aeronautical Lab., Bangalore (India).

INVESTIGATIONS ON VORTEX FLOWS

Y. V. G. Acharya, K. Krishnamurthy, and P. A. Irani Sep. 1965 59 p refs

(TN-AE-28-65) CFSTI: HC $3.00/MF $0.50

A tunnel was designed and fabricated, the salient features of the tunnel being a vertical duct fabricated from perspex for flow visualization and a cascade of entrance vanes with a mechanical device which can be operated so that all the vanes rotate simultaneously to effect a required incidence. One can obtain a purely axial flow or a helical flow in the tunnel. The report describes the results of flow investigations in the vortex tunnel at 15° vane angle. A reversal of flow has been observed. Increasing the vane incidence moved the reversal of flow region upstream. This movement is consistent with the behavior of the burst of a leading edge vortex, when the strength of the vortex is increased by raising the incidence. It has now been observed that the boundary layer growth on the wall of the tunnel was similar to that obtained by Y.V.G. Acharya in the Johns Hopkins University tunnel. The investigations in the JHU tunnel are also reported in this note. The results obtained in both tunnels have been compared and the agreement is satisfactory. Author

N66-15611# Aerodynamische Versuchsanstalt, Gottingen (West Germany).

ON THE DETERMINATION OF RESISTANCE CAUSED BY SLACK WATER BEHIND WEDGES [ZUR BESTIMMUNG DES TOTWASSERWIDERSTANDES MIT ANWENDUNG AUF TOTWASSER HINTER KEILEN]

M. Tanner 1964 71 p refs In GERMAN
(Rept.-31) CFSTI: HC $3.00/MF $0.75

A new flow model for the two-dimensional, axisymmetric slack water flow was introduced in the first part of this study. It was assumed that the slack water behind cut-off blunt bodies is of finite length. The second part of the study investigated the flow properties in slack water. Dependencies for the time-velocity relationship of the flow-mass influx into the slack water were formulated for the case where the measured slack water pressure values and the resistance values are known. Transl. by G.G.

N66-15641*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LIQUID BEHAVIOR IN THE RESERVOIR OF THE SOUND SUPPRESSOR SYSTEM

Helmut F. Bauer Washington, NASA, Jan. 1966 113 p refs
(NASA-TN-D-3165) CFSTI: HC $4.00/MF $0.75 CSCL 20D

A large water reservoir of rectangular plan form is part of a sound suppression system projected for use in the static firings of the booster stage of the Saturn V launch vehicle. Upon ignition of the rocket engines, a surge wave is created in the water mass at the discharge side of this reservoir. The surge wave will travel across the water surface and be reflected on the opposite wall, and thus travel back and forth until it is eventually damped out by wall and internal friction. Motion is investigated for a rectangular and a sinusoidal velocity respectively of one container wall. The liquid is considered incompressible, nonviscous, and irrotational. The velocity potential, free liquid surface displacement, velocity and pressure distribution, fluid force and moment have been obtained for various pulse durations. The wave form was computed electronically for a time coordinate with one-sixteenth second increments. These increments yield the wave motion in true time by assembling them in a film which shows quite lucidly the behavior of the liquid surface. Author

N66-15647# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

COMPRESSIBLE VISCOUS FLOW OVER SLENDER BODIES WITH PRESSURE GRADIENT, VARIABLE FLUID PROPERTIES, ARBITRARY LAWS OF SURFACE TEMPERATURE AND FOREIGN GAS INJECTION VELOCITY DISTRIBUTION

A. C. Jain and T. Y. Li Oct. 1965 90 p refs
(Contract Nonr-2168(03))
(AE-6504; AD-624446) CFSTI: HC $3.00/MF $0.75

A Gortler's type series solution is developed for compressible viscous flows over slender bodies with pressure gradient, variable fluid properties, arbitrary laws of surface temperature and foreign gas injection velocity distribution. A detailed analysis of the external flow is carried out in order to show the effect of the free-stream Mach number on the flow variables in the external stream and to enable us to correlate the boundary layer coordinate with the physical distance on the body of a simple analytical expression. Author (TAB)

N66-15696# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

A THREE-DIMENSIONAL SINGLE ROUGHNESS ELEMENT IN A TURBULENT BOUNDARY LAYER

H. W. Tieleman and V. A. Sandborn Sep. 1965 36 p refs
(Grant DA-AMC-28-043-64-G-9)
(AD-623902) CFSTI: HC $1.00/MF $0.50

An investigation of the influence of a single roughness element (sphere) in a turbulent boundary layer of a smooth flat plate is reported. The pressure distribution around the surface of the sphere was measured. Integration of the pressure distribution was used to compute the drag and lift forces on the element. Measurements of the mean and turbulent velocity distributions in the boundary-layer behind the sphere were made. Author (TAB)

N66-15723# TRW Systems, Redondo Beach, Calif. Physical Electronics Lab.

ELECTROFLUID HYPERSONIC RESEARCH Quarterly Report No. 2

B. Marcus and S. M. Zivi 11 Oct. 1965 35 p refs
(Contract AF 33(615)-2118)
(STL-4436-6003-SU-000; AD-624564) CFSTI: HC $2.00/MF $0.50

The report concerns the analysis of condensation and droplet growth in the nozzle, the separation of the two charged species, and the problem of pumping out the uncondensed gas to a low enough pressure that the required electrical fields can be attained without breakdown. TAB

N66-15731*# Northrop Corp., Newbury Park, Calif. Nortronics Applied Research Dept.

CALCULATION OF TWO-DIMENSIONAL TURBULENT FLOW FIELDS

John G. Trulio, William E. Carr, William J. Niles, and Richard L. Rentfrow Aug. 1965 108 p refs
(Contract NAS8-11400)
(NASA-CR-69539; NARD-15-R) CFSTI: HC $4.00/MF $0.75

Numerical solutions of the Navier–Stokes equations have been obtained for the flow of a compressible viscous fluid around a right circular cylinder. A computer code was specialized to the case of a Stokesian fluid and used to solve these problems. Eulerian boundary conditions were developed for

both subsonic and supersonic flow and put into the code. The Mach number in all flows was 0.2. The Reynolds number R was varied over the range R = 100 to R = ∞. Three different finite difference meshes were used to provide information on the effect of the mesh point density on the numerical solutions. Using our finest mesh, the code predicted sizable pressure fluctuations for R = 1000 in the neighborhood of the cylinder, at a dominant frequency of about 50 kilocycles. With sufficiently coarse meshes or appropriate time averages, the pressures calculated at various points of the cylinder were in fair agreement with those measured. Graphs of the pressure as a function of the cylinder angle θ are presented, as are many plots of the velocity fields obtained in the calculations.
Author

N66-15735# Oxford Univ. (England). Dept of Engineering Science.
THE MEASUREMENT OF SKIN FRICTION IN SUPERSONIC FLOW BY MEANS OF HEATED THIN FILM GAUGES
B. J. Belhouse and D. L. Schultz Oct. 1965 19 p refs
(Rept.-1002) CFSTI: HC $1.00/MF $0.50

The application of heated thin film gauges to the measurement of mean skin friction in compressible flow is described. It is shown that the calibration of the gauges is independent of Mach number, at least up to M=3, provided the fluid properties are calculated at the approximate film temperature. The gauges are calibrated by reference to surface tubes and also by comparison with the theoretical solution of Spalding and Chi.
Author

N66-15771*# Southwest Research Inst., San Antonio, Tex. Engineering Analysis Section.
SOME NOTES ON LIQUID SLOSHING IN COMPARTMENTED CYLINDRICAL TANKS Technical Report No. 1
H. Norman Abramson, Luis R. Garza, and Daniel D. Kana 15 Feb. 1962 19 p refs
(Contract NAS8-1555)
(NASA-CR-69545) CFSTI: HC $1.00/MF $0.50 CSCL 20D

As one relatively simple means of avoiding dynamic coupling between sloshing of liquid propellants and automatic control system response, or elastic body response, it has been suggested that propellant tanks be compartmented so as to raise or otherwise modify the normal sloshing frequencies. There is also the possibility of an overall reduction in the total force response as a result of phasing of the liquid motions in different compartments. Frequencies are also increased in the case of clustered tank configurations (over that for a single tank of the same capacity), but the weight penalty is more severe and additional complications may be introduced through other dynamic coupling effects. The present paper gives some results of experimental studies of frequencies and total force response in rigid tanks compartmented into sectors by vertical walls and excited in translation. These data are correlated with theoretical values, where available. Some theoretical values for cylindrical tanks with annular cross-sections are also shown for comparative purposes.
Author

N66-15781# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
REPORT OF THE MEETING OF THE FLIGHT MECHANICS SCIENTIFIC COMMITTEE ON 12–13 MAY 1964 IN OBERPFAFFENHOFEN [BERICHT UBER DIE SITZUNG DES FACHAUSSCHUSSES FLUGMECHANIK AM 12./13. MAI 1964 IN OBERPFAFFENHOFEN]
H. Fingado 29 Jun. 1965 77 p In GERMAN
(DLR-Mitt-65-04) CFSTI: HC $3.00/MF $0.75

Described are the various instruments and techniques used to study navigation parameters of the TRANSALL C 160 and the FOUGA CM 170 aircrafts. Measurement consoles utilized were able to register concurrently about 23 observations by oscillograph. Observed were static pressure, angle of attack, vertical and horizontal lift, acceleration, control flap movements, rudder and gas pressures, fuel consumption, and pilot performance.
Transl. by G.G.

N66-15839# Max-Planck-Institut für Strömunsforschung, Göttingen (West Germany).
STRESS DISTRIBUTION MEASUREMENT IN CIRCULAR CYLINDERS WITH EMPHASIS ON THREE DIMENSIONAL PERIPHERAL DISTURBANCE [DRUCKVERTEILUNGSMESSUNGEN AN KREISZYLINDERN MIT BEACHTUNG DREIDIMENSIONALER RANDSTORUNGEN]
K. Kraemer (Aerodyn. Versuchsanstalt) 1965 67 p refs In GERMAN Announced jointly with Aerodyn. Versuchsanstalt (Rept.-32) CFSTI: HC $3.00/MF $0.75

The stress distribution on a circular cylinder at right angles to the flow was measured in several low velocity wind tunnels with the cylinder spanning the breadth of the tunnel. This measurement should shed light on the three dimensional turbulent flow generated by the cylinder, the walls of the tunnel, and the flat plates mounted parallel to the flow boundary. In addition to the Reynolds number, other geometrical parameters which determine disturbances were systematically varied.
Transl. by W.K.

N66-15842# Max-Planck-Institut für Strömungsforschung, Göttingen (West Germany).
STRESS DISTRIBUTION AROUND A WEDGE IN INCOMPRESSIBLE FLOW: A CONTRIBUTION TO THE SLACK-WATER PROBLEM [DIE DRUCKVERTEILUNG AM KEIL BEI INKOMPRESSIBLER STROMUNG, EIN BEITRAG ZUM TOTWASSER PROBLEM]
K. Kraemer (Aerodyn. Versuchsanstalt) 1964 97 p refs In GERMAN Announced jointly with Aerodyn. Versuchsanstalt (Rept.-30) CFSTI: HC $3.00/MF $0.75

The flow about an isosceles wedge in the two dimensional wind tunnel stream of an incompressible fluid was examined. The wedge angle and the angle of attack were systematically varied. It was found that stress distribution on the wedge was primarily a function of the backwash. The comparison of the results with theoretical calculations showed the possibilities and limitations of the theory in which the backwater is replaced by a region of fluid at rest.
Transl. by W.K.

N66-15942# Aerodynamische Versuchsanstalt, Göttingen (West Germany).
THEORY OF WAKE FLOWS ABOUT WEDGES AT INCIDENCE [THEORIE DER TOTWASSERSTROMUNGUN UM ANGESTELLTE KEILE]
M. Tanner Mar. 1965 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-65-14; AVA-FB-65-02) CFSTI: HC $2.00/MF $0.50

A model is presented for wakes of two-dimensional sections at incidence in incompressible flow. The application of the theory on isosceles wedges gives pressure distributions and lift coefficients which agree well with measurements at small angles of attack.
Author

N66-15957# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillion-sous-Bagneux.
RECENT RESEARCH ON THE PROBLEMS OF RECOMBINATION CARRIED OUT AT O.N.E.R.A. [RECHERCHES RECENTES EFFECTUEES A L'O.N.E.R.A. SUR LES PROBLEMES DE RECOLLEMENT]
Pierre Carriere 1965 44 p refs In FRENCH Presented at 7th Symp. of Fluid Mechanics, Jurata, Poland, 1-3 Sep. 1965 (TP-275) CFSTI: HC $2.00/MF $0.50

Recent studies on the perturbation factors in the structure of the isobaric blending layer and the recombination zone in a free flow have led to an improved formulation of the Chapmen-Korst criterion. An attempt was made to distinguish among, and to elaborate a comprehensive theory for, the various characteristics of the recombination phenomenon. Some fundamental results already obtained in testing the theory are presented, and schematics of the flow structure are included.
Transl. by D.T.

N66-15967# Naval Ordnance Lab., White Oak, Md. Underwater Explosions Div.
DEVELOPMENT OF PROBES FOR MEASURING THE MAXIMUM RADIUS OF UNDERWATER EXPLOSION BUBBLES
D. E. Phillips and B. W. Scott 25 Oct. 1965 27 p refs
(NOLTR-65-176; AD-624510) CFSTI: HC $2.00/MF $0.50

An instrument for finding the position of a gaswater interface was developed and successfully used to measure the radius of an underwater explosion bubble. The change in conductivity between two parallel rods as the interface moves along the rods is recorded on film by an oscilloscope. Simultaneous photographic and probe measurements of maximum radii showed agreement within slightly over one percent. Bubble parameters obtained with the probes show some disagreement with free water measurements, possibly the result of flattening of the assumed spherical bubble by bottom and surface proximity.
Author (TAB)

N66-16042# Massachuseets Inst. of Tech., Cambridge. Gas Turbine Lab.
LAMINARIZATION OF THE TURBULENT BOUNDARY LAYER BY ACCELERATION
Brian E. Launder Nov. 1964 106 p refs Sponsored by GE and GM
(Rept.-77)

This report presents an experimental study of the development of turbulent boundary layers in very severe accelerations. It has been found that the tendency of the boundary layer to revert toward the laminar state, reported earlier in a preliminary study, can be continued until the layer does not differ in any essential feature from a laminar one. Despite the high residual turbulence signal in these fully laminarized boundary layers experiments have shown that the viscous shear stress far outweighs the turbulent by the end of the acceleration and, when the boundary layer is allowed to continue developing in zero pressure gradient, the mean velocity profile is consequently very similar to the Blasius solution for the laminar boundary layer. In particular, the eventual reversal of these boundary layers back to turbulent does not take place through an amplification and diffusion of the existing turbulence but rather by the initiation and growth of new turbulent bursts which appear to originate at the wall. These bursts are undeniably similar to those which occur when a laminar boundary layer undergoes natural transition.
Author

N66-16075*# Sperry Utah Co., Salt Lake City, Utah.
STUDY OF PURE FLUID PHENOMENA Final Report, May 28-Dec. 15, 1965
15 Dec. 1965 113 p
(Contract NAS8-20102)
(NASA-CR-69627) CFSTI: HC $4.00/MF $0.75 CSCL 13G

This report covers an experiment in dynamic pressure transmission in passive fluid circuits, and an investigation of a fluidic circuit for maintaining a constant pressure ratio across a load. The purpose of the first investigation is to verify the similarity laws for passive circuits. The experiments proved that similar conditions exist when the volume ratio of the passive circuits is constant, and the length to diameter ratio is changed to satisfy the similarity laws. The similarity equations have been found to contain too many assumed conditions. The assumption that the tube length to diameter ratio is constant had to be dropped in order to have sufficient variables. The purpose of the second investigation is the development of a pre-fluid pressure ratio regulator. Two concepts of regulation are considered. The first uses a single component, operating in a self-regulating mode. It is shown to be feasible for regulating supply pressure variations. The second concept makes use of a regulating system, involving sensors, feedback elements and control valves.
Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N66-15259 Joint Publications Research Service, Washington, D. C.
THE SPECTRAL CONSTITUTION OF DIRECT SUNLIGHT
Ye. A. Lopukhin *In its* Heliotechnology 21 Dec. 1965 p 40-44 refs (See N66-15251 06-03) CFSTI: $3.00

Tables are presented which show daily variations of the spectral composition of direct solar radiation at different sun heights in plain and mountainous areas, the percentages of ultraviolet and infrared radiation present in the total flux of direct radiation, and the absorption effects of varying humidity and cloudiness.
R.N.A.

N66-15282# Library of Congress, Washington, D. C. Aerospace Information Div.
THE SOVIET 300-METER METEOROLOGICAL TOWER Special Report
25 Mar. 1964 232 p refs Transl. into ENGLISH from the publ. "Izucheniye Pogranichnogo Sloya Atmosphery s 300-Metrovoy Meteorologicheskoy Bashni" Moscow, Akad. Nauk SSR, Inst. Prikl. Geofiz., 1963 p 41-159
(AID-U-64-20; AD-622236) CFSTI: HC $6.00/MF $1.25

CONTENTS:

1. PRINCIPAL PROBLEMS ARISING IN THE ORGANIZATION OF OBSERVATIONS ON THE METEOROLOGICAL TOWER A. A. Dmitriyev p 1-46 refs (See N66-15283 06-13)

2. RESULTS OF METEOROLOGICAL OBSERVATIONS ON THE HIGH TOWER G. B. Mashkova p 47-94 refs (See N66-15284 06-20)

3. INDIRECT EVALUATION OF TEMPERATURE ADVECTION AND THE MIXING COEFFICIENT FROM SMOOTHED TEMPERATURE MEASUREMENTS MADE FROM A TOWER A. A. Dmitriyev p 95-105 refs (See N66-15285 06-13)

4. ANALYSIS OF AN EXPERIMENTAL SERIES OF MEASUREMENTS OF THE HEAT AND RADIATION BALANCE Z. I. Volkovitskaya p 106–117 refs (See N66-15286 06-13)

5. CERTAIN CHARACTERISTICS OF THE TURBULENCE OF THE WIND FIELD IN THE LOWER 300-METER LAYER OF THE ATMOSPHERE V. N. Ivanov p 118–129 refs (See N66-15287 06-13)

6. THE TURBULENT DIFFUSION OF AN AEROSOL SETTLING FROM A POINT SOURCE LOCATED IN THE LOWER LAYER OF THE ATMOSPHERE N. L. Byzova p 130–143 refs (See N66-15288 06-13)

7. THERMODYNAMIC MODEL OF AN IDEALIZED PURELY THERMAL VERTICAL CIRCULATION OF THE ATMOSPHERE A. A. Dmitriyev p 144–153 refs (See N66-15289 06-13)

8. THE USE OF THERMODYNAMICS FOR EVALUATION OF THE EXTREME VALUES OF KINETIC ENERGY DISSIPATION IN THE ATMOSPHERE WHEN A WIND IS BLOWING A. A. Dmitriyev and M. G. Kroshkin p 154–161 refs (See N66-15290 06-13)

9. EXPERIENCE WITH STUDYING THE WIND FIELD AROUND A CYLINDRICAL TOWER WITH BALCONIES A. A. Dmitriyev p 162–185 (See N66-15291 06-13)

10. REDUCTION OF RANDOM ERRORS OF SMOOTHING DATA OBTAINED IN MEASUREMENTS ON METEOROLOGICAL TOWERS A. A. Dmitriyev p 186–209 refs (See N66-15292 06-13)

11. USE OF EMULSION POLYMERS AS ARTIFICIAL AEROSOLS A. K. Aleksandrova p 210–219 refs (See N66-15293 06-13)

12. A METHOD OF INVESTIGATION OF THE DISTRIBUTION OF AN ARTIFICIAL AEROSOL IN THE SURFACE BOUNDARY LAYER A. K. Aleksandrova p 220–228 refs (See N66-15294 06-13)

N66-15283 Library of Congress, Washington, D. C. Aerospace Technology Div.

PRINCIPAL PROBLEMS ARISING IN THE ORGANIZATION OF OBSERVATIONS ON THE METEOROLOGICAL TOWER [OSNOVNYE VOPROSY, VOZNIKAYUSHCHIYE PRI ORGANIZATSII NABLYUDENIY NA METEOROLOGICHESKOY VYSHKE]

A. A. Dmitriyev *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 1–46 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

Theoretical solutions to problems relating to the efficiency of meteorological towers are presented. Problems concerning the character of the mixing coefficient dependance on height; the thickness of the boundary layer with a constant heat flux and constant tangential friction; the mixing mechanism in the lower layers of the atmosphere; the formation of inversion and cloud layers; the vertical distribution of the intensity of icing; the lower boundary of low clouds; the structure of clouds and fogs; fluctuation processes in the atmosphere, and convective processes are considered. L.S.

N66-15285 Library of Congress, Washington, D. C. Aerospace Information Div.

INDIRECT EVALUATION OF TEMPERATURE ADVECTION AND THE MIXING COEFFICIENT FROM SMOOTHED TEMPERATURE MEASUREMENTS MADE FROM A TOWER [KOSVENNAYA OTSENKA ADVEKTSII TEMPERATURY I KOEFFITSENTA PEREMESHIVANIYA PO SGLAZHENNYM NABLYUDENIYAM TEMPERATURY NA MACHTE]

A. A. Dmitriyev *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 95–105 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

Temperature advection and mixing coefficient data from smoothed temperature measurements made from a meteorological tower are evaluated. The temperature observed on the tower is influenced strongly by cold or warm underlying surfaces and synoptic processes. Computations of the conditional coefficient $\mu(z)$ reveal that in the 300-m layer, it is virtually never possible to consider the atmosphere horizontally stratified without processes of lateral heat transport. Tabulated data on the conditional coefficient show that negative values of μ sometimes extend to all horizons (at 0100 hr), and sometimes are detectable at levels which are far apart (at 1000 and 1900), indicating that advective processes have a multilayered character. The results of examples of computations of the distribution of the mixing coefficient with height are graphically represented. L.S.

N66-15286 Library of Congress, Washington, D. C. Aerospace Information Div.

ANALYSIS OF AN EXPERIMENTAL SERIES OF MEASUREMENTS OF THE HEAT AND RADIATION BALANCE [ANALIZ OPYTNOY SERII NABLYUDENIY ZA TEPLOVYM I RADIATSIONNYM BALANSOM]

Z. I. Volkovitskaya *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 106–117 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

A series of actinometric and gradient observations were made in the vicinity of a high meteorological tower. On the basis of actinometric measurements, values of the radiation balance B, in cal/cm^2 min, were computed, and the results are presented in a summary table. The gradient observations of temperature, humidity, and wind velocity were made at times displaced by 10 minutes relative to standard actinometric observations, and the data obtained were used to compute the mixing coefficients K_1 at a level of 1 meter for the times of observation. Curves are given showing the diurnal variation of radiation balance and heat flux for different days of observation, and thermoisopleths of air are also depicted. The results are discussed. L.S.

N66-15287 Library of Congress, Washington, D. C. Aerospace Information Div.

CERTAIN CHARACTERISTICS OF THE TURBULENCE OF THE WIND FIELD IN THE LOWER 300-METER LAYER OF THE ATMOSPHERE [O NEKOTORYKH KHARAKHTERISTIKAKH TURBULENT-NOSTI VETROVOGO POLYA V NIZHNEM 300-METROVOM STOYE ATMOSFERY]

V. N. Ivanov *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 118–129 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

The results of turbulent air flow characteristics measurements in the lower 300-m layer of the atmosphere, made on a high meteorological tower are discussed. The distribution of the mean values of temperature and wind velocity with height, and turbulence intensity values are graphically presented. The average intensity of turbulence in the layer under consideration is approximately 15%. Also represented graphically are the computed values of turbulent energy of the longitudinal component of velocity. In contrast to intensity, the longitudinal component has a tendency to increase with height. From values of 1 to 3 m^2/sec^2 at the 50 m to 100 m horizons it increases to 3 to 5 m^2/sec^2 at heights of 200 m to 300 m. The horizontal dimensions of the turbulent nonhomogeneities were evaluated from computations for each working horizon using a Euler correlation function. The correlation functions obtained for a number of working levels are shown graphically. Turbulent energy data are used to evaluated values of turbulent diffusion. L.S.

N66-15288 Library of Congress, Washington, D. C. Aerospace Information Div.

THE TURBULENT DIFFUSION OF AN AEROSOL SETTLING FROM A POINT SOURCE LOCATED IN THE LOWER LAYER OF THE ATMOSPHERE [O TURBULENTNOY DIFFUZII OSEDAYUSHCHEY PRIMESI OT TOCHECHNOGO ISTOCHNIKA RASPOLOZENNOGO V NIZHEM SLOYE ATMOSPHERY]

N. L. Byzova *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 130–143 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

The turbulent diffusion of aerosol particles settling from a point source located on a balcony of a high meteorological tower is computed. The ejected particles were carried off by the wind, scattered, and settled as a result of the joint effect of gravity and vertical diffusion; and the distribution of the sediment along the surface of the earth was determined by sticky sheets distributed over the area in a network. Turbulent diffusion equations were used for computing the mean concentration of the admixture, and density formulas were used to compute the density of the settling admixture. The dependency of the dispersion on various parameters is shown, and the computated results are shown graphically. L.S.

N66-15289 Library of Congress, Washington, D. C. Aerospace Information Div.

THERMODYNAMIC MODEL OF AN IDEALIZED PURELY THERMAL VERTICAL CIRCULATION OF THE ATMOSPHERE [TERMODINAMICHESKAYA SKHEMA IDEALIZIROVANNOY CHISTO TERMICHESKOY VERTIKAL'NOY TSIRKULYATSII ATMOSFERY]

A. A. Dmitryev *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 144–153 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

In the development of a thermodynamic model of idealized purely thermal vertical circulation in the atmosphere, the maximum coefficient of useful effects follows a closed cycle in which the particle first ascends adiabatically and assumes the temperature of the surrounding air; then descends along an isostrat, during which it maintains this temperature until it reaches the boundary layer, at which point the initial temperature is resumed; and finally begins isobaric heating. An equation of the first order, rather than of heat conductivity, is obtained for this idealized case of cyclic reversible heat exchange; and the solution is represented in the form of a wave of finite velocity traveling from top to bottom. Also considered is the case in which the heat removed from the underlying surface is transformed into thermal energy and transmitted or radiated into the atmosphere. Equations are evolved for determining the maximum critical quantity of air masses involved in convective motion. When the model described is applied to the study of the useful effect coefficient in horizontal atmospheric circulation, values increase with increase in radiation cooling of the free atmosphere and decrease at the time of cooling through the underlying surface. M.W.R.

N66-15290 Library of Congress, Washington, D. C. Aerospace Information Div.

THE USE OF THERMODYNAMICS FOR EVALUATION OF THE EXTREME VALUES OF KINETIC ENERGY DISSIPATION IN THE ATMOSPHERE WHEN THE WIND IS BLOWING [PRIMENENIYE TERMODINAMIKI DLYA OTSENKI PREDEL'NYKH ZNACHENIY DISSIPATSII KINETICHESKOY ENERGII V ATMOSFERE PRI NALICHII VETRA]

A. A. Dmitriyev and M. G. Kroshkin *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 154–161 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

A thermodynamic cycle, abcd, is analyzed for evaluating the extreme values of kinetic energy dissipation in the atmosphere when a wind is blowing. The cycle is analyzed for the case when there is a mean wind velocity U(z) which changes with height z. It is assumed that the loss of kinetic energy occurs due to the transformation of mechanical energy into thermal energy in turbulent eddies. Each elementary eddy Γ_{z-r}, having a center at the height z–r, creates at the level z the additional velocity V, which carries along the mass $dm = \rho_z$ Vdzdy g/sec. The mass retains its potential temperature to the level z–2r, descending adiabitically (path a–b on the given thermodynamic cycle diagram). It is then assumed that in place of the classical process of mixing there will be isobaric cooling (path b–c of diagram) to the temperature $T_c = T_o$ of the surrounding space, and that adiabatic ascent begins to the initial height z (path c–d). The work of a unit mass in making one cycle abcd is computed. L. S.

N66-15291 Library of Congress, Washington, D. C. Aerospace Information Div.

EXPERIENCE WITH STUDYING THE WIND FIELD AROUND A CYLINDRICAL TOWER WITH BALCONIES [OPYT IZUCHENIYA POLYA VETRA OKOLO TSILINDRICHESKOY VYSHKI S BALKONAMI]

A. A. Dmitriyev *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 162–185 (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

The wind field around a cylindrical meteorological tower (with balconies) was studied by recording information on instruments attached to spars placed at given balcony levels. In the first series of experiments, the formulated problem was to check the extent of change of measured wind velocity with distance from the axis of the tower along a spar. Three anemometers were placed on all four spars at the eighth balcony at distances $R_1 = 3.5$, $R_2 = 5.25$, $R_3 = 7.0$ from the axis of the tower. Ten experiments were run, and all revealed the presence of appreciable changes in velocity along the spars in the range 1.5–2.0 m/sec. The purpose of a second series of experiments was to determine whether the body of the horizontal spar itself exerted an influence on the results of the measurements. Other experiments are also described, and the results are tabulated, plotted, and discussed. L.S.

N66-15292 Library of Congress, Washington, D. C. Aerospace Information Div.

REDUCTION OF RANDOM ERRORS OF SMOOTHING DATA OBTAINED IN MEASUREMENTS OF METEOROLOGICAL TOWERS [OB UMEN'SHEENII SLUCHAYNYKH OSHBOK SGLAZHIVANIYEM PRI IZMERENIYAKH NA METEOROLOGISCHESKIKH MACHTAKH]

A. A. Dmitriyev *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 186–209 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

Computations are worked out for reducing random errors occurring in the smoothing of atmospheric wind, temperature, and stability data obtained in measurements made by instruments on at various heights on a meteorological tower. A two-parameter and a three-parameter model are considered along with other methods. Curves of smoothed data are shown. The results indicate the feasibility of using a two-parameter model when the heights change in a geometric progression and for levels with a monotonic variation of the averaged element. A three-parameter model is more advantageous in measurements at equal intervals of heights and during variation of an element not having more than one extremum in the interval of the moving region of smoothing. L.S.

N66-15293 Library of Congress, Washington, D. C. Aerospace Information Div.

USE OF EMULSION POLYMERS AS ARTIFICIAL AEROSOLS [ISPOL'ZOVANIYE EMUL'SIONNYKH POLIMEROV V KACHESTVE ISKUSSTVENNYKH AEROZOLEY]

A. K. Aleksandrova *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 210–219 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

The shape, detection, and coloring of luminescent emulsion polymers is discussed for consideration of their use as artificial aerosols. Aerosols are used for studying patterns of turbulent diffusion and other motions of the atmosphere. Considerations indicate that emulsion polymers can be used in geophysical investigations for studying the transport of admixtures in the air; and that they also can be used as an indicator of the medium itself, since the rate of settling of particles with a diameter less than 30μ is so insignificant that their dissemination occurs mostly under the influence of turbulent flux. The spherical forms of the particles considered makes it possible to dispense with the introduction of a coefficient which takes into account the deviation of the form of the particle from spherical. The luminescent method makes it possible to detect individual particles with diameters greater than 10μ on large surfaces, both easily and rapidly. L.S.

N66-15294 Library of Congress, Washington, D. C. Aerospace Information Div.

A METHOD OF INVESTIGATION OF THE DISTRIBUTION OF AN ARTIFICIAL AEROSOL IN THE SURFACE BOUNDARY LAYER [METODIKA ISSLEDOVANIYA RASPROSTRANENIYA ISKUSSTVENSOGO AEROZOLYA V PRIZEMNOM SOLYE]

A. K. Aleksandrova *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 220–228 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

A method of investigating the distribution of powdered admixtures of artificial aerosols in the surface air boundary layer is described. The powders are colored with luminescent substances, (such as rhodamine S and other dyes) which appear as different colors under UV light. The powders are introduced into the atmosphere by instruments set on the platforms of a meteorological tower in such a way that the stream of powder emerging from the instrument is perpendicular to the wind direction. The disseminated powder particles eventually settle over the experimental area where a network of sticky surfaces trap particle samples for post-analysis. Distribution patterns and isolines of the surface concentration of the particles are then mapped from the experimental data. It was found that a natural snow or sand cover could be used in lieu of sticky sheets for trapping particle samples. Various methods of particle counting are described. L.S.

N66-15326# Columbia Univ., Palisades, N. Y. Lamont Geological Observatory.

A BASIC STUDY OF ELASTIC WAVE PROPAGATION Final Report, 28 Jun. 1963–31 Dec. 1964

James Dorman [1964] 8 p

(Contract DA-31-124-ARO(D)-136)

(AROD-4120-2; AD-623592) CFSTI: HC $1.00/MF $0.50

Abstracts are given of the following publications: Relative excitation of surface waves by earthquakes and underground explosions in the California-Nevada region; Surface wave radiation patterns for underground nuclear explosions and small magnitude earthquakes; Use of surface wave rejection filters to record mantle waves of low order; Travel times, body waves, and dispersion in the earth; Travel times, body waves, and normal modes of the earth. TAB

N66-15353*# Pittsburgh Univ., Pa. Dept. of Physics.

IONOSPHERIC REACTION RATES IN THE LIGHT OF RECENT MEASUREMENTS IN THE IONOSPHERE AND THE LABORATORY, II

T. M. Donahue 5 Aug. 1965 40 p refs

(Grant NASr-179)

(NASA-CR-69351; SRCC-11) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Laboratory measurements of ion–molecule reaction rates and recombination coefficients at 300° K were obtained which are consistent with recent mass spectrometric determinations of the abundance of ionic species in the ionosphere. As altitude and temperature increase, observations call for decreasing rate coefficients in all cases except the rate for N_2^+, O charge transfer. It appears to be necessary that the dissociative recombination coefficient for NO^+ decreases at $T_e^{-1.4 \pm 0.2}$ while that for O_2^+ decrease more slowly. The coefficient for N_2^+ probably decreases slowing with temperature. Rates for N_2^+, O and O^+, N_2 ion atom interchange and for O^+, O_2 charge transfer all must decrease with temperature to be compatible with ionospheric data. Mass spectrometric data for the night time ionosphere are consistent with the same set of reaction rates with their temperature dependences deduced from daytime observations. This is true only if weak primary ionization sources are present. One source causes ionization at a rate of 5 to 10 ion pairs/cm^3 sec above 180 km. Another produces about 10 ion pairs/cm^3 sec near 130 km at night. The conversion of O_2^+ to NO^+ by charge transfer in the latter case appears to be an efficient process. R.N.A.

N66-15359*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

N_2 TEMPERATURE AND DENSITY DATA FOR THE 150 to 300 KM REGION AND THEIR IMPLICATIONS

N. W. Spencer, D. R. Taeusch, and G. R. Carignan (Mich. Univ.) Dec. 1965 33 p refs

(NASA-TM-X-55362; X-620-66-5) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Measurements of the concentration of N_2 in the thermosphere obtained by a thermospheric probe, and temperatures derived from the resulting density profiles when compared with similar parameters derived from satellite drag, as represented by current model atmospheres, lead to inconsistencies. Typically, the near daytime maximum and the near nighttime density observed (2.0×10^9/cc and 1.2×10^9 cc at 200 km) and the corresponding temperatures (825° K and 725° K) indicate that the assumption, for model atmosphere purposes, of constant boundary conditions at 120 km should be expanded to reflect, probably, a significant diurnal variation. Author

N66-15384*# Pittsburgh Univ., Pa. Dept. of Physics.

THE EFFECT OF LATERAL FLOW ON EXOSPHERIC DENSITIES

John Robert Mc Afee (Ph.D. Thesis) 15 Sep. 1965 118 p refs

(Contract NASr-179; Grants NsG-416; NSF G-11309)

(NASA-CR-69352; SRCC-12) CFSTI: HC $4.00/MF $0.75 CSCL 04A

Lateral flow in a collisionless exosphere at the top of the earth's atmosphere is calculated for a spherical geometry. The model consists of an exobase surface below which a Maxwellian distribution is assumed and above which particles describe elliptical orbits. The net flux into the exobase surface is the difference between the flow in from all other points on the surface and the flow out from below. The difference arises from both variations in density and temperature on the exobase surface. The net fluxes calculated for atomic oxygen and

molecular nitrogen and oxygen are too small to cause a departure from diffusive equilibrium. The flux for helium toward the night side could be supported by diffusion but is sufficiently large to question the assumption of diffusion equilibrium. The hydrogen flux is larger than can be supported by diffusion from below and would necessitate a more complicated approach to calculations of its density distribution. In any case, the hydrogen night-time bulge would persist. Author

N66-15416# Instituto y Observatorio Astronomico de Marina, San Fernando (Spain).

METEOROLOGICAL AND MAGNETIC OBSERVATIONS. CORRESPONDENCE OF THE YEARS 1961–1962 [OBSERVACIONES METEOROLOGICAS Y MAGNETICAS. CORRESPONDIENTES A LOS ANOS 1961–1962]

F. Fernandez de la Puente 1965 163 p In SPANISH *Its* Anales, Sec. 3.A CFSTI: HC $5.00/MF $1.00

Tabulated data on meteorological and geomagnetic observations collected during 1961 and 1962 by the Marina Institute and Observatory located in San Fernando, Spain are presented. Daily and monthly data are included on atmospheric pressure, temperature, water vapor pressure, relative humidity, wind direction and velocity, rainfall, and magnetic field variations. R.N.A.

N66-15420*# Stanford Univ., Calif. Radioscience Lab.

MEASUREMENTS OF THE TOTAL ELECTRON CONTENT AND THE EQUIVALENT SLAB THICKNESS OF THE MID-LATITUDE IONOSPHERE

R. V. Bhonsle, Aldo V. da Rosa, and O. K. Garriott [1964] 31 p refs Submitted for Publication

(Grant NsG-30)

(NASA-CR-60710) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The total electron content N_T and the equivalent slab thickness τ of the mid-latitude ionosphere are determined from differential Doppler measurements on the radio transmissions from the Transit 4A satellite and the ionosonde data near Washington, D. C. and Ottawa. The trends of diurnal, seasonal, and sunspot cycle variations of N_T and τ at midday are described. The inferred mean electron–ion temperature is found to be generally in excess of the neutral gas temperature. The ratio T_e/T_g in the daytime is estimated to be 1.8 in summer and about 1.1 to 1.2 in winter, which may reflect corresponding changes in the ratio Q/N_e^2, where Q is the heat input to the electrons and N_e is the electron density. The relationship between τ and K_p appears to be rather ambiguous in contrast with the positive correlation between the neutral gas temperature and K_p. Author

N66-15438*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.

VARIATIONS IN THE TOTAL ELECTRON CONTENT OF THE IONOSPHERE AT MID-LATITUDES DURING QUIET SUN CONDITIONS

Steven L. Solomon 30 Nov. 1965 76 p refs *Its* Sci. Rept.-256

(Grant NsG-114-61)

(NASA-CR-69389) CFSTI: HC $3.00/MF $0.75 CSCL 04A

The Faraday rotation effect on satellite signals has been used to determine the electron content of the ionosphere at mid-latitudes. The ambiguity in the total number of rotations along the ray path has been resolved by using the method of closely-spaced frequencies. Observations of the total electron content of the ionosphere made over a five month period are presented and compared with values obtained in similar experiments in previous years. Horizontal gradients are discussed with sunrise effects being considered. Diurnal and day-to-day variations in content are shown, and conclusions are drawn associating variations in the magnitude and gradient of the total electron content with magnetic activity. Author

N66-15446*# Harvard Univ., Cambridge, Mass. Dept. of Geological Sciences.

MINERALOGY OF SULFIDE NODULES IN SOME IRON METEORITES

Frederick B. Henderson, III Jun. 1965 56 p refs

(Grant NsG-282)

(NASA-CR-69382) CFSTI: HC $3.00/MF $0.50 CSCL 08G

Forty mineral phases occurring in sulfide nodules from the Canyon Diablo, Cosby's Creek, Hex River, Magura, Toluca, and Trenton iron meteorites are described. The characteristic occurrence of these phases in a nodule rim and core structure is described; and common compatible assemblages are noted, many of which appear to be high temperature. Accessory phases, in general, have probably exsolved from the principal nodular mineral, troilite. A similar association and textural sequence of phases in the nodules studied indicates similar conditions of formation. Several silicate-troilite intergrowths suggest a possible reaction between sulfide and silicate phases. The silicate phases may have been mechanically included in the nodules, or may have resulted from primary crystallization. deformation textures were observed that indicate pre-terrestrial metamorphism. Alteration Fe–Ni–S phases, including pentlandite and "heazlewoodite", appear to represent Ni-metasomatism by diffusion of Ni into the nodule from adjoining primary nickeliferous phases during metamorphism. Author

N66-15450*# Harvard Univ., Cambridge, Mass. Mineralogical Museum.

CATALOGUE OF THE METEORITE COLLECTIONS

Jun. 1965 43 p refs

(Grant NsG-282)

(NASA-CR-69375) CFSTI: HC $2.00/MF $0.50 CSCL 08G

The Harvard University meteorite collection is catalogued according to locality, date, classification, number of specimens, weight of largest specimen, and total weight. The listing includes 524 meteorites with a total weight of 2140 kilograms. Among these are the entire mass of Carbo, which weighs 546 kg, and the Washington County ataxite. Others include the iron Seymour, three complete masses of the Coahuila hexahedrite, a complete mass of Canyon Diablo, and masses from the Brenham fall and Baquedane; as well as some notable chondritic meteorites, including parts of Cynthiana, Tulia, and New Concord. M.W.R.

N66-15451# Joint Publications Research Service, Washington, D. C.

SOVIET STUDIES IN METEOROLOGY AND HYDROLOGY, NO. 11, 1965

21 Dec. 1965 92 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 11, 1965 p 3–13, 33–54, 57–61

(JPRS-33447; TT-65-34021) CFSTI: $3.00

CONTENTS:

1. ATMOSPHERIC MOTION IN EQUATORIAL LATITUDES V. S. Purganskiy p 1–14 refs (See N66-15452 06-13)

2. PROGNOSTIC SIGNIFICANCE OF SOME CHARACTERISTICS OF THE TEMPERATURE AND PRESSURE FIELDS IN THE LOWER STRATOSPHERE N. M. Zakharova p 15–25 refs (See N66-15453 06-13)

3. EXTINCT CYCLONE PHOTOGRAPHED FROM A SATELLITE A. D. Zamorskiy and L. S. Minina p 26–35 refs (See N66-15454 06-20)

4. A METHOD FOR CORRECTION OF LONG-TERM PRECIPITATION NORMS L. R. Struzer, I. N. Mechayev, E. G. Bogdanova, and Ye. A. Fedorova p 36–46 refs (See N66-15455 06-20)

5. AGROMETEOROLOGICAL INDICES OF FLAX-FIBER GROWTH L. V. Andrianova p 47–54 refs (See N66-15456 06-04)

6. OUTGOING RADIATION AND THE RADIANT HEAT FLUX K. Ya. Kondrat'yev p 55–62 refs (See N66-15457 06-20)

7. NEW SOVIET BOOKS ON METEOROLOGY p 63–68

8. NEWS OF THE MAIN ADMINISTRATION OF THE HYDROMETEOROLOGICAL SERVICE p 69–72

9. SOVIET CONFERENCES AND MEETINGS ON METEOROLOGY p 73–76

10. NOTES ON SOVIET METEOROLOGICAL INSTRUMENTS p 77–79

11. UNUSUAL METEOROLOGICAL PHENOMENA OBSERVED IN USSR p 80

12. FOREIGN METEOROLOGICAL NEWS PUBLISHED IN SOVIET JOURNAL p 81–83

N66-15452 Joint Publications Research Service, Washington, D. C.

ATMOSPHERIC MOTION IN EQUATORIAL LATITUDES

V. S. Purganskiy *In its* Soviet Studies in Meteorol. and Hydrol. 21 Dec. 1965 p 1–14 refs (See N66-15451 06-13) CFSTI: $3.00

A problem is formulated based on the hypothesis that if the atmosphere has a change in heat source within a one-year period, there can be a change of wind within a two-year period. For its solution, system of hydrothermodynamic equations is written, applicable to the narrow equatorial region where the components of Coriolis force associated with the horizontal components of velocity can be omitted in the equations of motion. It is assumed that this region is bounded by the circles of latitude $\theta' = \pm 5°$, and that the functions entering into the equations are not dependent on longitude. M.G.J.

N66-15453 Joint Publications Research Service, Washington, D. C.

PROGNOSTIC SIGNIFICANCE OF SOME CHARACTERISTICS OF THE TEMPERATURE AND PRESSURE FIELDS IN THE LOWER STRATOSPHERE

M. M. Zakharova *In its* Soviet Studies in Meteorol. and Hydrol. 21 Dec. 1965 p 15–25 refs (See N66-15451 06-13) CFSTI: $3.00

Efforts to detect asynchronous relationships in the development of the temperature and pressure fields in the lower stratosphere are discussed. The characteristic development of synoptic processes in the northern hemisphere was studied, based on observational data over a seven year period (1958–1964). September was considered the central month of the natural synoptic autumn season, and variations in temperature and pressure were analyzed for several of the preceding months. Tabulated data show the differences in values, and the monthly fluctuations. Two groups are considered, based on well-developed or poorly developed cyclonic activity, and the influence of each is discussed. It was noted that these findings give an indication of the general character of the expected circulation of the atmosphere and weather. M.G.J.

N66-15499# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.

STUDIES OF SOLAR FLARE EFFECTS AND OTHER IONOSPHERIC DISTURBANCES WITH A HIGH FREQUENCY DOPPLER TECHNIQUE

V. Agy, D. M. Baker, and R. M. Jones 28 Apr. 1965 150 p refs

(ARPA Order 183)

(NBS-TN-306; AD-467520) GPO: $0.75

This report presents some results of work done with a Doppler technique for studying ionospheric disturbances. The theoretical results include a calculation of the frequency shifts to be expected from changes in the parameters of a parabolic model ionosphere and a method of determining the height variation of the time rate of change of electron density during ionospheric disturbances. It is shown that the frequency shift, with oblique propagation, is the same as that with vertical propagation on the equivalent vertical-incidence frequency. The experimental results include a comprehensive catalog of all flare effects observed from 1 October 1960 through 31 December 1962, a statistical study of these flare effects, and the Doppler records of some solar flare effects detected during this period. A model in which the time rate of change of electron density is zero below the bottom of the E layer, and constant above that height, explains the frequency dependence of the maximum Doppler shifts observed during some solar flares. Author (TAB)

N66-15501# Weapons Research Establishment (Australia).

ATMOSPHERIC STRUCTURE AT 130–200 KM ALTITUDE FROM OBSERVATIONS ON GRENADE GLOW CLOUDS DURING 1962–63

K. H. Lloyd and L. M. Sheppard Sep. 1965 34 p refs (WRE-HSA-19) CFSTI: HC $2.00/MF $0.50

Glows have been observed at night and at twilight when aluminized grenades have been detonated in the altitude range of 100 to 200 km. From observations made with equipment located on the ground, the variation with time of the radiance distribution across the glow clouds has been determined, and is used to calculate the molecular diffusion coefficient in the region from 130 to 200 km. The derivation of atmospheric density and temperature from the molecular diffusion coefficient is discussed in some detail, and results are presented for a number of Skylark rocket firings at Woomera during 1962 and 1963. The estimated maximum error in density is 30%, and in temperature is 15%. Within the limit of these errors, no diurnal effects have been detected. Above 150 km altitude, the observations have shown that the initial cloud radii are two to three times greater than predicted. A qualitative explanation of this effect is given by combining blast wave theory with molecular flow theory. Author

N66-15511# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE AMBIGUITY IN DETERMINATION OF VELOCITY OF PROPAGATION OF A SEISMIC WAVE FROM A TRAVEL-TIME CURVE

M. L. Gerver and V. M. Markushevich 4 Nov. 1965 13 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 163, no. 6, 1965 p 1377–1380

(JPRS-32728; TT-65-33207) CFSTI: $1.00

A problem is formulated to represent the geophysical determination of the velocity cross section from the travel-time curve. It is assumed that seismic pulses are propagated along seismic rays in conformity with the laws of geometrical optics. Velocity of pulse propagation is dependent only on depth. Following reduction and transformation, and an equation for the problem is devised and limitations in obtaining the solution are considered. Properties of functions are clarified, certain notations are introduced, intervals are selected, and some assumptions are made in order to investigate the propagation velocity of a seismic wave from a travel-time curve. M.W.R.

N66-15516# France. Direction de la Meteorologie Nationale, Paris.
TEMPERATURES IN THE STRATOSPHERE [TEMPERATURES DANS LA STRATOSPHERE]
A. Tasson, A. Beau and R. Bubeck Oct. 1965 30 p refs In FRENCH Monograph No. 53 CFSTI: HC $2.00/MF $0.50

Relationship between various temperatures and altitudes of 16, 20, 25, and 30 km is tabulated from data obtained from various ground stations throughout the Northern Hemisphere. The four temperatures given for each station and altitude include absolute minimum, absolute maximum, and temperatures which would not exceed 84% and 97.7% of the measurements taken. These temperatures are also presented on a series of maps of the Northern Hemisphere. Transl. by M.W.R.

N66-15521# India. Dept. of Atomic Energy, Bombay.
MEASUREMENTS OF RADIOACTIVE FALLOUT IN INDIVIDUAL RAIN SHOWERS AT BOMBAY
V. S. Bhatnagar and S. Sadasivan 1965 37 p refs
(AEET-215) CFSTI: HC $2.00/MF $0.50

A few individual rain shower samples were collected at Bombay during the 1963 monsoon, and the fallout radioactivity of rain water due to Cs-137, Ru-106, and Zr-95 was determined using a gamma-ray scintillation spectrometer. Efforts were made to relate the variation in specific radioactivity to rainfall intensity, wind, and lowest cloud base heights. Generally, the trends in the radioactivity concentration of rain water, as a rain shower progressed with time, were found to be independent of precipitation rate, cloud base height, and the existing meteorological conditions. Also considering the mean specific radioactivity of a whole shower, the variations from shower to shower were found to be unaffected by general meteorological conditions. On the basis of these observations it is surmised that the trends in the specific radioactivity of rain water during the course of a rain shower are determined primarily by the cloud processes. Author

N66-15524# Joint Publications Research Service, Washington, D. C.
RADIO WAVE PROPAGATION IN THE EARTH'S CRUST
A. M. Ryazantsev and A. V. Shabel'nikov 29 Dec. 1965 36 p refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 10, no. 11, Nov. 1965 p 1923–1940
(JPRS-33519; TT-65-34093) CFSTI: $2.00

This article is devoted to a survey of the theoretical and experimental works containing data about the physical and electrical properties of the Earth's crust and their connection with temperature, pressure, and humidity. Methods of calculating a field in an absorbing medium whose electrical properties are constant in time and space, or change in space in one definite direction, are considered. Author

N66-15575# Weapons Research Establishment (Australia).
IONOSPHERIC DATA FOR JULY 1964 FROM WOOMERA, SOUTH AUSTRALIA Ionospheric Data Bulletin
Jan. 1965 32 p
(CPD-1964/7(W)) CFSTI: HC $2.00/MF $0.50

Tabulated data on hourly values of customary ionospheric parameters obtained from a meteorological station at Woomera, South Australia for July 1964 are presented. R.N.A.

N66-15601# Illinois Univ., Urbana. Electrical Engineering Research Lab.
IONOSPHERIC RESEARCH Seventh Quarterly Progress Report, 1 Apr.–30 Jun. 1965
H. D. Webb [1965] 107 p refs
(Contract DA-36-039-ANC-03703(E))
(Rept.-7; AD-623259) CFSTI: HC $4.00/MF $0.75

The object of the ionospheric research is to collect data by receiving signals by reflection from the moon and measuring the Faraday Rotation; to use the data to calculate the electron content of the ionosphere above the earth; to study the diurnal, seasonal, and irregular changes in electron content; to correlate irregular changes in electron content with other natural phenomena; and to study the reflecting surface of the moon. TAB

N66-15602# Illinois Univ., Urbana. Radiolocation Research Lab.
AN INVESTIGATION OF LARGE-SCALE IONOSPHERIC DISTURBANCES OBSERVED IN A RADIOLOCATION EXPERIMENT Technical Report No. 28
David G. Detert Oct. 1965 138 p refs
(Contract Nonr-1834(02))
(RRL-288; AD-623580) CFSTI: HC $4.00/MF $1.00

Measurements of the azimuthal and vertical angles of arrival were made during the afternoon and early evening on pulse transmissions at 5 Mcs over a 452 km east to west path using a six-element interferometer antenna system. The large systematic variations appearing in rapid time series measurements are shown to be due to the passage of large-scale traveling ionospheric disturbances through the transmission path. A model is proposed for these perturbations, consisting of a long front whose cross section is elliptically elongated in the horizontal direction and whose interior contains an increase or decrease of electron density over the background profile values. The angle of arrival variations which should be characteristic of the passage of such irregularities are developed. The variations are seen to be dependent on the direction of travel of the disturbances, and data samples showing each of the several characteristic variations are presented. Vertical incidence swept-frequency ionospheric soundings taken at one minute intervals at both the midpoint and receiving endpoint of the path are used to confirm the identification of the particular disturbance for each of these samples. TAB

N66-15604# Colorado State Univ., Fort Collins. Fluid Mechanics Program.
METEOROLOGICAL-TOWER INDUCED WIND-FIELD PERTURBATIONS
G. Hsi and J. E. Cermak Oct. 1965 88 p refs
(Grant DA-AMC-28-043-64-G-9)
(CER65GH-JEC49; AD-623946) CFSTI: HC $3.00/MF $0.75

The objective of this study was to determine how the presence of a typical meteorological tower disturbs the local wind pattern. This study provides data which can be used to correct wind speeds measured by anemometers in the field. Experimental results in this paper are based on data taken upstream of, around, and downstream from a 1:4 scale model of a 20 ft segment of the prototype tower. Author (TAB)

N66-15623# Weapons Research Establishment (Australia). Dept. of Supply.
IONOSPHERIC DATA FOR APRIL 1965 FROM WOOMERA, SOUTH AUSTRALIA Ionospheric Data Bulletin
Jul. 1965 28 p
(CPD-1965/4(W)) CFSTI: HC $2.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given for the station at Woomera for April 1965. Author

N66-15624# Weapons Research Establishment (Australia). Dept. of Supply.
IONOSPHERIC DATA FOR NOVEMBER 1964 FROM SALISBURY, SOUTH AUSTRALIA Ionospheric Data Bulletin
Jul. 1965 30 p
(CPD-1964/11(S)) CFSTI: HC $2.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given for the station at Salisbury for November 1964. Author

N66-15625# Hermanus Magnetic Observatory (South Africa).
SOUTH AFRICAN ANTARCTIC SCIENTIFIC RECORDS: MEASUREMENTS OF TOTAL MAGNETIC INTENSITY DURING VOYAGES OF THE "RSA", DECEMBER 1964–APRIL 1965
H. D. Poole and A. M. van Wijk Aug. 1965 21 p refs *Its* Geophys. Ser. 1
(Rept.-B4) CFSTI: HC $1.00/MF $0.50

The results of magnetic measurements carried out on board the Antarctic supply ship "RSA" on two relief voyages during the period Dec. 1964–Apr. 1965, are presented in tabular form. Measurements were between Cape Town and Marion Island made at intervals of half an hour or longer from 0900 to 1930 U.T. on December 30, 1964; from 1730 to 1930 on December 31; and from 1530 to 1830 on January 1, 1965. The observations were discontinued at 0630 U.T., January 2 owing to equipment trouble (twist on cable). The observations on Marion Island were made on the site of one of the two magnetic stations previously established on the Island. (Wiid and Van Wijk, 1960). Because of the magnetic nature of the terrain, readings were taken at ground level and at heights of 3 ft. and 6 ft. above the ground. The measurements made at 6 ft. gave consistent values while those at 3 ft. and at ground level were adversely affected by local magnetic conditions. Readings between Cape Town and Gough Island were taken at half-hourly intervals throughout the period 0730 U.T., April 14, 1965, to 0100 U.T., April 20. The magnetic traverse extended from 33°11'S., 14°28'E to about 40°12'S., 08°20'W. Author

N66-15627*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
DYNAMICAL HEATING OF THE UPPER ATMOSPHERE
C. O. Hines [1964] 25 p refs Submitted for Publication
(Grant NsG-467)
(NASA-CR-69496) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The energy that is deposited in the ionosphere, by internal atmospheric gravity waves propagating upward from below, is assessed on the basis of recent observational data. The implied heating rates are found to range from 10°K/day (near the 95-km level) to 100°K/day (near 140 km), and they therefore compete with solar radiation as the primary source of heating in the ionospheric E region. The tidal input may be comparable, but its height of deposition is more difficult to assess. The residual wave energy that reaches the F region carries a flux that may exceed 10^{-4} watt/m^2, so it may play a significant role in determining the heat budget of these higher levels. The waves should be accompanied by reversible temperature fluctuations of ±10°K and more, low in the E region, and they may therefore account for irregular temperature structure that has been reported. Author

N66-15628# Library of Congress, Washington, D. C. Aerospace Technology Div.
THE LOWEST ELECTRON DENSITY NECESSARY FOR WAVE REFLECTION FROM THE IONOSPHERIC D-LAYER SURVEYS OF SOVIET SCIENTIFIC AND TECHNICAL LITERATURE
G. Nestorov 1 Dec. 1965 11 p refs Transl. into ENGLISH from Compt. Rend. Acad. Bulgare Sci. (Sofia), v. 18, no. 7, 1965 p 631–634
(ATD-65-108)

Proceeding from Alpert's magneto–ionic theory, a formula was derived for the complex ionospheric refraction of long- and medium-waves in the day time. Transformation equations were developed and applied to determine the electron density required for long- and medium-wave reflection from the D-region. Considered were quasi-longitudinal propagations in the shorter wavelength region of the medium waves, and long-wave propagations in the case of oblique wave incidence. G.G.

N66-15650# Pennsylvania State Univ., University Park. Ionospheric Research Lab.
INVESTIGATION OF PROBLEMS ENCOUNTERED IN WAVE INTERACTION EXPERIMENTS AT HIGH POWER
C. D. Bell 14 Jan. 1966 71 p refs
(Grant Nonr-656(35); NSF GP-846)
(SR-262; AD-624847) CFSTI: HC $3.00/MF $0.75

The wave interaction equations are extended to account for nonlinearities which are noticeable at high disturbing powers. Previous assumptions are investigated to see if they are still valid. A suitable nonlinear approximation is derived for ionospheric heating. This approximation leads to an accurate analytical approximation for the interaction effect at high powers. It was found that ionospheric parameters will be able to be synthesized using high powered interaction. A preliminary study indicated the feasibility of synthesizing electron temperature form interaction data Author (TAB)

N66-15659# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
DETERMINATION OF IONOSPHERIC LOSS COEFFICIENTS FROM OBSERVATIONS ON SATELLITE X-RAY FLUXES AND SUDDEN IONOSPHERIC DISTURBANCES Scientific Report No. 252
Ashesh P. Mitra 1 Oct. 1965 32 p refs
(Contract AF 19(628)-4014; Grant NSF GP-2914)
(AFCRL-65-779; AD-624392) CFSTI: HC $2.00/MF $0.50

Use has been made of recent satellite measurements of solar flare X-ray flux, and where available its spectral distribution, for detailed quantitative examination of the accompanying sudden ionospheric disturbances, principally sudden cosmic noise absorption (SCNA). From observed or assumed spectral distributions of the X-ray flux, profiles of ion production rates are obtained for a few specific events. A comparison of these production rates with the observed excess attenuation during the peak of the SCNA leads to an upper limit for the value of the effective dissociative recombination coefficient, α_c, when negative ions are ignored. These limiting values were found to range between 0.0000001 to 0.000001 cc/s. When the effect of negative ions is considered, α_c is reduced to values around (1–4) × 10^{-8} cc/s. An extension of the above method involves the simultaneous use of SCNAS and SPAS at very low frequencies, along with X-ray spectral data. When this is done, it is possible to obtain information on both the dissociative recombination coefficient and negative ions. Author (TAB)

N66-15664# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

MORPHOLOGY OF HIGH LATITUDE GEOMAGNETIC DISTURBANCE AND CORRELATIONS WITH SATELLITE MAGNETIC FIELD MEASUREMENTS **Scientific Report No. 253**

Donald H. Fairfield 15 Oct. 1965 134 p refs

(Contract AF 19(628)-4014; Grant NSF GP-2914)

(AFCRL-65-780; AD-624317) CFSTI: HC $4.00/MF $1.00

Arctic magnetograms were investigated in order to obtain an improved understanding of the morphology of high latitude magnetic disturbance. A comparison of the disturbance on different days shows that the ionosphere currents producing the disturbance are never very different from the DS current pattern but are also never extremely similar to one another. The direction of current across the polar cap is toward the sun in the summer but is rotated about 40 degrees clockwise (looking down on the north pole) in the winter. Arctic magnetograms were also compared to simultaneous Explorer XII measurements of the magnetic field in the transition region outside the magnetosphere. A southward field measured by the satellite was found to correspond to ground disturbance and a northward field to quiet periods. These results are interpreted as supporting the field reconnection mechanism of Dungey whereby the interplanetary magnetic field becomes attached to high latitude earth dipole lines, thus allowing the solar wind to drive the ionospheric current. Author (TAB)

N66-15673# Bern Univ. (Switzerland). Physikalisches Institut.

RARE GAS MEASUREMENTS IN 30 STONE METEORITES

P. Eberhardt, O. Eugster, J. Geiss, and K. Marti Nov. 1965 43 p refs Submitted for Publication CFSTI: HC $2.00/MF $0.50

The concentrations and isotopic composition of He, Ne and Ar in 29 chondrites and 1 achondrite have been determined. Detailed accounts of the experimental technique used and the reproducibility and accuracy obtained are given. The U, Th-He^4 and K-Ar ages derived from our results are in agreement with the already known age distributions of the different chondrite classes. Our measurements have revealed a linear correlation between the $(He^3/Ne^{21})_{spall}$ and the $(Ne^{22}/Ne^{21})_{spall}$ ratios, following the equation (constants for chondrites):

$$He^3/Ne^{21} = 2.40 + 23.4(Ne^{22}/Ne^{21} - 1)$$

The significance of this correlation and its possible application in detecting diffusion losses are discussed. The radiation ages derived confirm the salient features observed in the radiation age distributions of the different chondrite classes. Five new meteorites with trapped gases were found (2 solar type, 3 planetary type). Author

N66-15679# National Physical Lab., New Delhi (India). Radio Propagation Unit.

STUDY OF F-LAYER EFFECTS WITH DOPPLER FADING TECHNIQUE **Interim Progress Report, Apr. 1964–Aug. 16, 1965**

A. P. Mitra, A. K. Saha, and C. V. Subrahmaniam [1965] 25 p Sponsored by NBS CFSTI: HC $1.00/MF $0.50

Statistical results are presented for optical observations on solar flares, solar radio noise bursts, magnetic crochets, and various sudden ionospheric disturbances in a study of F-layer effects with a Doppler fading technique. A new method of analysis is suggested for the reduction of F-layer contribution to sudden cosmic radio noise absorption effects of solar flares. Studies have indicated that X-ray enhancements in solar flares in the 10 to 100A range account for about the 90% of the magnitude of the sudden frequency deviations noted on the dopplometer; any ionization enhancements are considered to be in the E-region. The dopplometer and other equipment are described. M.W.R.

N66-15689# Chicago Univ., Ill. Cloud Physics Lab.

PROJECT WHITETOP **Final Report, Apr. 4, 1964–Apr. 3, 1965**

Roscoe R. Braham, Jr. 25 Oct. 1965 37 p refs

(Grant NSF G-22419)

Various aspects of basic and applied research in rain physics and weather modification are discussed. In the studies, attention was centered upon understanding and modifying, to the extent possible, the precipitation processes in summer convective clouds of southern Missouri. The basic cloud studies and the randomized seeding experiments were conducted during June, July, and August; an operational summary on these activities is included. Laboratory and field tests on the organic chemical, urea, showed that it is a useful seeding agent and is effective as an ice nucleant, because it is hygroscopic and has a high endothermic heat of solution. Contributions resulting from the study are identified as (1) providing documentation of the condensation-coalescence (warm rain) mechanism in the development of rain in the Missouri summer clouds; and (2) showing that the ice phase in these clouds is controlled by the prior development of coalescence rain in a manner which is not typical of the classical Bergeron mechanism. M.G.J.

N66-15747# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).

REVIEW OF LITERATURE ON OCEANOGRAPHY AND NAVIGATION [OCEANOGRAPHY, NAVIGATION LITERATUUROVERZICHT]

10 Oct. 1965 36 p In ENGLISH and DUTCH *Its* Vol. 2, No. ON-13

CFSTI: HC $2.00/MF $0.50

A variety of subjects dealing with oceanography and navigation are reviewed in a literature survey. Abstracts deal with physical oceanography, the chemistry of sea water, geophysics, and oceanographic and hydrographic equipment. General navigation problems are included as well as abstracts on equipment and instruments for sea, air, land, and space navigation. M.W.R.

N66-15751# American Meteorological Society, Boston, Mass.

BIBLIOGRAPHY ON PHYSICAL OCEANOGRAPHY OF THE INDIAN OCEAN

Parkash Samuel Jun. 1965 137 p refs *Its* Spec. Bibliog. on Oceanog. Contrib. No. 2

(Contract N62306-1145)

(AD-624466) CFSTI: HC $4.00/MF $1.00

The scope of this bibliography is limited to the different aspects of physical oceanography, viz.: temperature, density, salinity, chemical composition, waves, currents, circulation, methods of measurements, instruments, etc. Papers on bottom topography, geology and biology have been excluded. Material on the weather and climate of the Indian Ocean, of its islands and of the Indian Subcontinent has been reserved for future bibliographies. TAB

N66-15805# Lockheed Missiles and Space Co., Palo Alto, Calif.

FURTHER INVESTIGATIONS OF STORM-TIME SUB ELF EMISSIONS

Lee Tepley, R. C. Wentworth, and K. D. Amundsen 25 Jul. 1964 24 p refs

(Contract Nonr-4454(00))

(LMSC-4-28-64-1; AD-625993) CFSTI: HC $1.00/MF $0.50

This report is concerned with the following properties of certain types of sub ELF emissions (delta f = 0.2-5 cps) observed during magnetic storms: (1) The aural characteristics of the emissions obtained from time-compressed magnetic tape; (2) the frequency-time (f-t) characteristics of the emissions as displayed on sonagrams; (3) the degree of simultaniety of emissions observed simultaneously at widely separated locations (the four Lockheed Pacific Ocean Stations); and (4) the relationships between the occurrence times of the emissions and the following quantities: (a) Magnetic Kp index, (b) local time of day, and (c) local sunset. Perhaps the most interesting result of the investigation is the observation that storm-time sub ELF emissions seem to excite natural resonances in the exosphere. This effect is explained in terms of an existing theoretical model. Also of interest is the observation that the signals are most frequently observed near 800 PM local time. The occurrence time seems to indicate that the signal source is asymmetric with respect to the sun-earth line. Author (TAB)

N66-15851# Naval Oceanographic Office, Washington, D. C.

STATIONARY WIND-DRIVEN CURRENTS IN THE NON-HOMOGENEOUS OCEAN OF VARIABLE DEPTH [STATSIONARNYYE VETROVYYE TECHENIYA V NEODNORODNOM OKEANE PEREMENNOY GLUBINY]

L. M. Fomin 1965 24 p refs Transl. into ENGLISH from Tr. Inst. Okeanol., Akad. Nauk SSSR (Moscow), v. 66, 1963 p 29–45

(TRANS-257; AD-623811) CFSTI: HC $1.00/MF $0.50

The theoretical basis of a computation method for steady wind-driven current velocities (the deep ocean with complex bottom topography) is discussed in this paper. The value of the water transport depends on the vorticity of shearing stress of the wind and on the bottom slope. Ways of transition from water transport to the current velocities in the individual layers are considered (a) when the water density distribution is known and (b) when the water mass structure corresponds to the given model. Author

N66-15866*# Pittsburgh Univ., Pa.

SPACE RESEARCH COORDINATION CENTER. AN INTERPRETATION OF A FAR ULTRAVIOLET DAYGLOW EXPERIMENT

T. M. Donahue 15 Oct. 1965 30 p refs

(Contract NASr-179)

(NASA-CR-69623; SRCC-18) CFSTI: HC $2.00/MF $0.50 CSCL 04A

The altitude profile to 700 km of the OI 1302-06 dayglow brightness produced by resonance scattering of sunlight is calculated for the conditions prevailing at the time of Fastie's high altitude rocket experiment. The experimental results fit the calculated profile only above 550 km. Below there is an excess of radiation for which a primary excitation profile is calculated. The rate has a maximum of about 30 per cm^3 near 190 km. It is also sufficient with reasonable modifications to account completely for the excitation of the altitude profile of the 1356 line. The altitude profile observed for the Lyman α line is shown to be consistent with a hydrogen abundance between 4 and 10×10^{13} atmos/cm^2 above 100 km and indicates a large increase in the hydrogen content of the atmosphere at solar minimum. Author

N66-15878# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.

EXPERIMENTAL DETERMINATION OF THE SPEED OF ICE MOVEMENT WITHIN A GLACIER BY GEOPHYSICAL METHODS

B. A. Borovinski Dec. 1965 12 p refs Transl. into ENGLISH from Vestn. Akad. Nauk Kaz. SSR (Alma-Ata), no. 12(153), 1957 p 56–60

(T-442-R) CFSTI: HC $1.00/MF $0.50

An attempt to determine the velocity of ice movement within a glacier by geophysical methods is described. Electric survey methods were used, and the results were recorded by tracing equipotential lines, by measuring the potentials, and by measuring the potential gradient. Each of these methods are described, and results of potential difference and potential gradient measurements are tabulated. It is concluded that the simplest and most precise method is by measuring the potential difference. C.T.C.

N66-15880# Defence Research Telecommunications Establishment, Ottawa (Ontario).

ALOUETTE I IONOSPHERIC DATA (ALOSYN), 1–15 NOVEMBER 1962

30 Jun. 1965 159 p

CFSTI: HC $4.00/MF $1.00

A tabulation is given of topside sounder synoptic data consisting of selected ionospheric parameters obtained from Alouette I ionograms. The Alouette I satellite is in an almost circular orbit with an inclination of 80.5°, the orbital period is 105.4 minutes, and the topside sounder radio frequency changes continuously from 0.5 to 11.5 Mc/s. Such data as the ordinary wave penetration frequency of the F-2 layer, the quality of the reflection trace at the extraordinary wave penetration frequency, and the quality of sporadic E are given. C.T.C.

N66-15881# Defence Research Telecommunications Establishment, Ottawa (Ontario).

ALOUETTE I IONOSPHERIC DATA (ALOSYN), 16–30 NOVEMBER 1962

30 Jun. 1965 147 p For abstract see N66-15880 06-13

CFSTI: HC $4.00/MF $1.00

N66-15899# Kiruna Geophysical Observatory (Sweden).

PLASMA WAVES IN THE FREQUENCY RANGE 0.001–10 CPS IN THE EARTH'S MAGNETOSPHERE AND IONOSPHERE. A SURVEY Final Report

Bengt Hultqvist Jun. 1965 138 p refs

(Contract AF 61(052)-619)

(AFCRL-65-683; AD-622223) CFSTI: HC $4.00/MF $1.00

The plasma model for the magnetosphere and ionosphere is first discussed. A review of some parts of the theory for a warm collisionless plasma of interest in the magnetosphere in connection with waves of periods between 0.1 and 1000 seconds is given. The theory for magnetohydrodynamic waves in a slightly ionized gas is then summarized. The available observational data about magnetospheric and ionospheric phenomena, which may be interpreted in terms of waves with periods between 0.1 and 1000 seconds, are briefly surveyed and some theoretical applications to the ionosphere and magnetosphere are finally discussed. Most of the report is devoted to warm-plasma theory. The theory of shock phenomena and transients in the magnetosphere is not included in the report.

Author (TAB)

N66-15938# United Electrodynamics, Inc., Pasadena, Calif. Earth Sciences Div.
EVALUATION TESTS, NATIONAL GEOPHYSICAL COMPANY SEISMOMETER TYPE 21
G. F. Francis 13 Oct. 1964 26 p
(Contract AF 33(657)-7747)
(Rept.-21; AD-609525) CFSTI: HC $1.00/MF $0.50

This report describes the results of the evaluation tests. A table summarizing the results obtained from the tests is presented. Measured or computed values of the various parameters are compared with the manufacturer's specifications and with equivalent values for the Johnson-Matheson seismometer. The manufacturer's specifications on damping and natural frequency were confirmed by the test. Mass, weight and the maximum travel were not measured. In general, the J-M and National-21 systems are similar. However, thunderstorm activity caused much larger signals on the National-21 than on the J-M system. The magnification of the National-21 system is approximately 40% of that of an equivalent J-M system when used as a current sensitive device feeding a low impedance amplifier. If used as a voltage-sensitive device feeding a high impedance amplifier, the magnification of the National-21 is approximately 65% higher than that of the J-M. Author (TAB)

N66-15951# Joint Publications Research Service, Washington, D. C.
DETERMINATION OF ATMOSPHERIC DENSITY WITH A ROCKET-BORNE THERMISTOR
S. P. Perov 11 Jan. 1965 11 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 61, 1965 p 86–92
(JPRS-33679; TT-66-30123) CFSTI: $1.00

It is demonstrated that with appropriate selection of the thermometric body and its placement on a rocket it can be used in measuring the density of the free atmosphere at great heights. This paper gives some results of application of this method to measurement of density at heights of 60–80 km. Author

N66-15965# National Physical Lab., New Delhi (India). Radio Propaganda Unit.
PLASMA DIFFUSION IN THE IONOSPHERE
S. Chandra 15 Jun. 1965 13 p refs *Its* Sci. Rept.-22 Submitted for Publication
(RPU-S-22) CFSTI: HC $1.00/MF $0.50

An equation of continuity is derived for the F region without assuming ambipolar diffusion. It is shown that the commonly employed form of the equation of continuity remains unaltered if the divergence of electron and ion fluxes are equal. It is further shown that the so-called diffusion term in the equation implicitly includes the effect of electric field. An expression for electric field is derived which is applicable to a situation in which the plasma density and electric potential varies in the vertical direction only. Author

N66-16004# St. Louis Univ., Mo.
THE DETERMINATION OF CRUSTAL THICKNESS FROM THE SPECTRUM OF P WAVES Scientific Report No. 13
Luis M. Fernandez Bedford, Mass., AFCRL, Sep. 1965 186 p refs
(Contract AF 19(604)-7399; ARPA Order 292; Proj. VELA-Uniform)
(AFCRL-65-766; AD-624844) CFSTI: HC $5.00/MF $1.00

The layers of the earth's crust act as a filter with respect to seismic energy arriving at a given station. Consequently the motion recorded at the earth's surface depends not only on the frequency content of the exciting seismic energy and on the response characteristics of the recording instrument, but also on the elastic parameters and thicknesses of the layers. This latter dependence is the basis for a method of investigating the structure of the crust. TAB

N66-16018*# Auckland Univ. (New Zealand).
[RADIO PROPAGATION STUDY] Semiannual Progress Report, 1 Jun.–30 Nov. 1965
J. E. Titheridge [1965] 9 p refs
(Grant NsG-54)
(NASA-CR-69660) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A variety of techniques for studying the ionosphere using radio signals received from artificial satellites are outlined. Summarized are results of projects on: irregularities and electron content of the polar ionosphere from records of the Polar Ionosphere Beacon satellite; measurements on the geostationary satellite Syncom 3; ray path through the ionosphere; computer programs for accurate calculations of the effects of the ionosphere on satellite signals; elevation angle measurements; and studies of large ionospheric irregularities using specially designed chart readers to plot the Faraday fading period from the 20 Mc/s satellite records. M.R.W.

N66-16077*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
STUDIES OF THE STRUCTURE OF THE IONOSPHERE Final Report
[1965] 78 p refs
(Contract NASw-342)
(NASA-CR-69707; LMSC-8-26-65-1) CFSTI: HC $3.00/MF $0.75 CSCL 04

The ionospheric profile up to 1000 km is studied with an ion trap and two mass spectrometers flown in a Javelin sounding rocket. The quadrupole ion mass spectrometer required flight testing and this was accomplished by flying it and an ion trap in a Nike-Apache rocket preliminary to the more expensive Javelin flight. Ion concentration and valuable ion temperature data were obtained. The latter data showed unexpected temperature stratification in the E- and lower F-regions at midday with peak-to-valley temperature differences of several hundred degrees. The Javelin rocket containing an ion trap, a quadrupole ion mass spectrometer, and a magnetic light ion mass spectrometer was flown near local midnight on July 7, 1964. Ion concentration and temperature profiles were obtained from the ion trap and an ion composition profile was obtained from the quadrupole mass spectrometer. Unexpected rocket motions rendered analysis difficult, but the results are nevertheless meaningful. Author

N66-16084*# Schjeldahl (G. T.) Co., Northfield, Minn. Advanced Programs Div.
THEORETICAL STUDY AND ENGINEERING DEVELOPMENT OF JIMSPHERE WIND SENSOR Final Report, 27 Feb. 1964–1 Jun. 1965
Clinton V. Eckstrom Jul. 1965 98 p refs
(Contract NAS8-11158)
(NASA-CR-69714) CFSTI: HC $3.00/MF $0.75 CSCL 04A

Jimsphere wind sensor balloons of 2-meter diameter having various sizes, shapes, and quantities of roughness elements molded into the balloon material, have been fabricated and flight tested to determine the optimum design for control of flow separation and stabilization of the sphere wake. The Jimsphere wind sensing balloon reaches an altitude of approximately 18 kilometers within one hour. Wind tunnel tests have

been conducted to determine the drag coefficient of a model Jimsphere and full-scale tests were conducted to determine the apparent mass factor for the Jimsphere configuration. A considerable discrepancy exists between the drag coefficients determined from flight data and those determined in the wind tunnel. No explanation is given for this difference. Theoretical investigations of the Jimsphere have concerned development of the equations of motion which include effects of apparent mass and wind accelerations, determination of wind response capabilities and wind gradient error factors due to wind response lag. Author

N66-16159*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RELATION BETWEEN THEORETICAL AND OBSERVATIONAL MODELS OF THE UPPER ATMOSPHERE
I. Harris and W. Priester (Bonn Univ. Obs.) 5 Jul. 1963 20 p refs
(NASA-TM-X-55239; X-640-63-145) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Theoretical working models for the solar-cycle variation of the upper atmosphere are compared with observational data obtained during times of medium and low solar activity. The observational models are for the years 1958/59, 1960, 1961 and 1962. An appreciably good agreement is found for all levels of solar activity, taking into consideration the large magnitude of air density changes that occur during the solar cycle. Towards the lowest level of solar activity, however, a systematic deviation appears. This deviation yields an empirical relation which should be taken into account when using the models. An even better agreement of the theoretical and observational models is obtained if in the theoretical models the amount of helium is increased by a factor of 2.5 at the boundary of 120 km. L.S.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N66-15212# Army Electronics Labs., Fort Monmouth, N. J.
DESIGN OF 15-Mc MICROELECTRONIC COUNTER FOR THE LASER RANGE FINDER
George A. Hrivnak Dec. 1964 69 p
(ECOM-2543; AD-624096) CFSTI: HC $3.00/MF $0.75

This report covers the design, fabrication and evaluation of a 15-Mc microelectronic laser range counter. The model which was developed measures only 1 1/4" × 3 1/4" × 5" and weighs only 13 oz. It employs silicon integrated circuits, "chip and wire circuits" and micro-modules. It is completely maintainable, and provides full performance over the temperature range of +150° F to −40° F. The microelectronic laser range counter is operationally equivalent to the counter employed in the XE-6 laser range finder. A 66% size reduction and a 75% weight reduction were achieved. Author

N66-15297*# Princeton Univ., N. J. Dept. of Biology.
IMAGE CONTRAST AND PHASE MODULATED LIGHT METHODS IN POLARIZATION AND INTERFERENCE MICROSCOPY. INSTRUCTION MANUAL FOR THE PAR EPM-1 PHOTOELECTRIC POLARIZING AND INTERFERENCE MICROSCOPE
Robert D. Allen [1964] 88 p refs Submitted for Publication
(Contract NASr-159)
(NASA-CR-60392) CFSTI: HC $3.00/MF $0.75 CSCL 20F

Consideration is given to phase retardation measurements in polarization and interference microscopy, the theory and application of phase modulation methods, and the design of an instrument for quantitative microscopy. In the phase retardation area, comparisons are made of the theory and practice of measurements by the generation of image contrast through interference, and by electronic detection using phase modulation methods. Topics examined in the theory and application area are the measurement of phase retardations due to birefringence, the measurement of optical rotation, optical rotation in the presence of birefringence, and the measurement of phase retardations due to refraction with a polarizing interference microscope. The optical system, calibration and error, and the electronic detection system are among the areas considered relative to the design of the photoelectric polarizing and interference microscope. An instruction manual is included for this instrument. C.T.C.

N66-15391*# Illinois Univ., Urbana, Ill. Coordinated Science Lab.
PHOTO CURRENT SUPPRESSOR GAUGE DEVELOPMENT Final Report
W. L. Schuemann Mar. 1965 27 p refs
(Grant NsG-376; Contract DA-28-043-00073(E))
(NASA-CR-69342; R-249) CFSTI: HC $2.00/MF $0.50 CSCL 14B

A type of ionization gauge called the photo current suppressor gauge has been developed at the Coordinated Science Laboratory of the University of Illinois during the past three years. This gauge is capable of effectively suppressing the photoelectric current (X-ray current) from the ion collector, thereby considerably extending the range of ionization-type gauges. Simple suppressor gauges have a limitation similar to the X-ray limit of the Bayard–Alpert gauge at 1×10^{-13} Torr. Slightly more complicated suppressor gauges probably would not be limited by an X-ray effect above 1×10^{-16} Torr, though this has not been experimentally verified. These gauges have a higher sensitivity than typical inverted gauges, are only slightly more complicated, and can use the same power supplies and electrometers. Author

N66-15393*# Midwest Research Inst., Kansas City, Mo.
EXTREME VACUUM TECHNOLOGY INCLUDING CRYOSORPTION, DIFFUSION PUMP AND PRESSURE CALIBRATION STUDIES Quarterly Status Report No. 8, 1 May–1 Aug. 1965
Paul J. Bryant and Charles M. Gosselin 27 Aug. 1965 25 p refs
(Contract NASr-63(06))
(NASA-CR-69333) CFSTI: HC $1.00/MF $0.50 CSCL 14B

A description of cold cathode magnetrons and Penning cells operating as gauges has been developed in terms of the conditions for establishing a discharge and the effects of space charge buildup. Pressure response curves for three commercial gauges were determined by a conductance-regulated, pressure-ratio method using Bayard–Alpert type gauges for reference. Four characteristics are predicted from the discharge

mechanism and correlated with test data for the normal magnetrons: (1) an out-of-strike state characterized by a steady pressure-independent background reading of about 5×10^{-14} Torr; (2) a minimum pressure threshold for operation; (3) a range of nonlinear pressure-dependent response above threshold in which the sensitivity rise with pressure is moderated by space charge buildup; followed by (4) a range of near linear response corresponding to the region of nearly saturated space charge. Differences in response values are correlated with differences in electrode elements, spacings, and voltages for the two magnetron gauge tube designs. The operation of a Penning cell such as used in the trigger gauge is similar to that of a magnetron since the electron cloud forms a virtual cathode concentric with the anode. This report therefore concentrates upon the description of magnetron type discharges.
Author

N66-15410*# Hughes Research Labs., Malibu, Calif.
RESEARCH ON GRAVITATIONAL MASS SENSORS Research Contract Status Report, 15 Sep.–15 Oct. 1965
Robert L. Forward 25 Oct. 1965 6 p
(Contract NASw-1035)
(NASA-CR-69361) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Tests conducted on double ended, torsion wire sensor mounts of different diameters are briefly outlined, and the possible use of a single ended torsion mount is mentioned. An optimization analysis of the piezoelectric transducers, used to detect the strains in the sensor arms, indicate that the barium titanate transducers are suitable.
M.G.J.

N66-15496*# Electro-Optical Systems, Inc., Pasadena, Calif.
DEVELOPMENT OF A SECOND GENERATION PROTOTYPE REFLECTOMETER FOR REFLECTANCE MEASUREMENT IN SPACE Final Technical Report
Arthur A. Olsen, Peter A. Button, and Donald H. Mc Clelland [1963] 54 p refs
(Contract NAS1-4660)
(NASA-CR-66010; EOS-6520-Final) CFSTI: HC $3.00/MF $0.50 CSCL 20F

A full-scale prototype rotating arm reflectometer has been designed, built, and tested. The prototype instrument has an overall diameter of 50.8 cm, an overall height of 23.4 cm, and a weight of approximately 13 kg. It serially measures the specular reflectance of a number of reflective surface samples which are mounted on the prototype. Control and power circuitry are mounted remotely in a control box attached to the prototype by a cable. Six measurement channels are provided. One uses an integral tungsten lamp as a source, and the other five channels use energy from the sun. Of the solar channels, one measures the total reflected energy, while the other four make spectral measurements in the bands 0.3–0.45μ, 0.45–0.65μ, 0.65–1.2μ, and 1.2–2.0μ. In the prototype, nine sample positions are provided, spaced on a radius of 23 cm. Two of the nine sample positions are occupied by reference samples. Internally, the optical beams of the reflectometer are chopped at a frequency of 105 cps by a tuning fork chopper. Detection is by lead sulphide detectors, followed by amplification and signal processing circuitry which gives a dc output in each channel which is proportional to the reflectance of the sample being scanned. The arm is gear driven by a dc gearhead motor. Nominal arm rotation speed is about 3 rpm.
Author

N66-15526# Sperry Gyroscope Co., Ltd., Brentford (England).
AIRCRAFT GYROSCOPIC FLIGHT INSTRUMENTS
Jan. 1965 144 p 7th Ed.
CFSTI: HC $4.00/MF $1.00

A handbook containing information on gyroscopic flight instruments is presented. Described are automatic pilot and flight controls, gyro-magnetic compasses, gyro horizons, integrated instrument systems, remote gyros, zero reader flight directors, and turn-and-slip indicators. Information on a twin gyro platform, a fully maneuverable attitude and heading reference system is also presented. The initial chapter includes a study of the principles of the gyroscope.
M.R.W.

N66-15610*# New Mexico State Univ., University Park. Observatory.
ELECTRONIC SHUTTER CONTROL FOR PLANETARY PHOTOGRAPHY WITH AUTOMATIC TIME RECORDING CAPABILITY
C. F. Mozer Dec. 1965 17 p refs
(Grant NsG-142)
(NASA-CR-69488; TN-701-66-11) CFSTI: HC $1.00/MF $0.50 CSCL 14E

An electromechanical shutter system incorporating semiconductor electronics and featuring mechanical simplicity is described. The system also incorporates a simple and accurate means of triggering accessory devices at the time of shutter opening. This capability is used to automatically record the times at which exposures are made—a convenience of great importance in planetary photography.
Author

N66-15618*# TRW Systems, Redondo Beach, Calif. Space Sciences Lab.
DEVELOPMENT OF AN ENGINEERING PROTOTYPE ION MASS SPECTROMETER FOR THE MASS ANALYSIS OF THE LUNAR ATMOSPHERE Final Report
R. W. Fredricks and R. H. Abramson 25 Sep. 1965 60 p refs
(Contract NASw-1022)
(NASA-CR-69480; STL-4190-6012-SU-000) CFSTI: HC $3.00/MF $0.50 CSCL 03A

An ion mass spectrometer of the Paul type, and having a one-quarter circular geometry has been shown to have the mass resolution and transmission factor properties expected from both theoretical considerations and from results of laboratory experiments using linear quadrupole structures. The spectrometer has been found to operate satisfactorily at high incident ion currents where a simple Faraday cup current detector and standard laboratory micro-microammeter provide adequate measurements. The spectrometer has been subjected to an ultraviolet light test which yielded an upper limit to the light transmission of the unblacked, curved structure. The operation of the ion mass filter in an ambient plasma having Debye lengths comparable to instrument dimensions has been studied. It has been found that in this type of plasma, the sheath effects present serious calibration problems. However, for reasonable model lunar atmospheres, sheath effects will be unimportant because of the very large Debye length. Recommendations for areas of future concentrated research and development have been outlined. The area which presents the greatest developmental problem is that of high sensitivity particle detection systems for use at low ambient ion flux densities.
Author

N66-15654# Rome Air Development Center, Griffiss AFB, N. Y. Space Surveillance and Instrumentation Branch.
ENVIRONMENTAL CONTROL AND INSTALLATION OF A PRECISION AERIAL CAMERA Final Report, 1 Aug. 1964–30 Jun. 1965
Charles W. Fortney Nov. 1965 34 p refs
(RADC-TR-65-375; AD-624742) CFSTI: HC $2.00/MF $0.50

A precision aerial camera used in radar evaluation was installed in an aircraft. Installation factors which contribute to the camera system errors were studied to minimize the additional errors introduced when the camera is operated at high altitudes in an unprotected area of an aircraft. The selection of the unprotected area of an aircraft. The selection of the aircraft camera window and an environmental chamber along with its temperature control system are discussed. It is shown that temperature regulation is essential, while variations in pressure produce negligible errors. Camera stabilization and isolation from the aircraft was not necessary in these tests to prevent degradation of the camera resolution. Test data show that preheating the camera chamber prior to flight, along with regulated heat input, is essential to provide a uniform camera temperature for the duration of the flight. It is concluded that the required camera system accuracy of −10 microns on the photo scale can be achieved when the installed camera, including the camera window, is calibrated and operated in a temperature-controlled environment. Schematics and blueprints of a typical installation are included. Author (TAB)

N66-15674# Weapons Research Establishment (Australia).
INSTRUMENTATION TRIAL DE5/5: ANALYSIS OF INSTRUMENT PERFORMANCE
W. W. Barnes Oct. 1965 29 p refs
(WRE-SAD-40) CFSTI: HC $2.00/MF $0.50

The results of the analysis of records are presented and discussed. These show that attempts to remove previously unexplained radar bias errors have been partially successful. Radar angular errors were generally within specification. However, there were large range bias errors. The performances of the Contraves and Askania systems were satisfactory. The ballistic cameras at the Rangehead did not produce satisfactory records as the flashing light was too far from the cameras to be photographed clearly. The ballistic cameras at Mirikata produced satisfactory records. The problems of target noise and atmospheric refraction are dealt with and the result of investigations into these two phenomena are given. Author

N66-15694# Western Ontario Univ., London. Racetrack Microtron Group.
THEORY AND DESIGN OF A RACE-TRACK MICROTRON WITH APPLICATION TO THE GENERATION OF MILLIMETER WAVES
Heinrich R. Froelich and Eric Brannen Dec. 1964 125 p refs
(Grant AF-AFOSR-297-63)
(RMG-T-1; AFOSR-65-1626; AD-623802) CFSTI: HC $4.00/MF $1.00

The race-track microtron treated is a four-sector design with homogeneous magnetic fields in the sectors. Synchronism and phase stability are investigated for an energy gain that is variable from 0.5 to 1.0 MeV. Stability of betatron oscillations is examined using the 'hard-edge' approximation for the shape of the magnetic field. The design of a race-track microtron is described, whose basic feature is its adaptability to different pole-piece arrangements. Beam bunching in a microtron permits its application to the generation of millimeter and submillimeter waves. The mechanism causing beam bunching is investigated theoretically. Generation of 8 mm waves using the beam of a conventional microtron is described. Author (TAB)

N66-15715# Army Electronics Labs., Fort Monmouth, N. J.
A SIMPLE LEVEL INDICATOR FOR LIQUID HELIUM AT ALL TEMPERATURES
R. M. Wasilik, D. A. Neeper, and D. C. Pearce Aug. 1965 13 p refs
(ECOM-2626; AD-624471) CFSTI: HC $1.00/MF $0.50

Characteristics of a very simple liquid helium level indicator for all temperatures are described. Levels can be measured with an accuracy of ±1 millimeter using a carbon resistor, battery and multimeter with a negligible liquid helium loss. Author (TAB)

N66-15724# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
A FREQUENCY MEASURING SPECTRUM ANALYZER
Charles S. Wilson and Walter B. Warren Griffiss AFB, N. Y., RADC, Nov. 1965 77 p
(Contract AF 30(602)-3282)
(RADC-TR-65-338; AD-624698) CFSTI: HC $3.00/MF $0.75

The report describes the theory of operation and the construction of three related systems which can be used to measure the frequency of the individual components of a composite signal spectrum. The frequency measurement is made by selectively synchronizing a phaselocked oscillator to each component and counting the output of this marker oscillator. By using the marker oscillator in conjunction with or as an integral part of a spectrum analyzer, a visual indication of the frequency location of the marker oscillator with respect to the other components is obtained. Two of the systems operate in the region of 455 kc while the third tunes 4–30 Mc and is used in conjunction with a 455 kc system to measure the original RF frequency of components that appear in the IF passband of a receiver. Author (TAB)

N66-15784*# Metrophysics, Inc., Santa Barbara, Calif.
ADVANCED TRANSDUCERS. PHASE A: INVESTIGATION OF DIGITAL TRANSDUCERS AND DIGITAL COMPATIBILITY TECHNIQUES
Nov. 1965 237 p refs
(Contract NAS8-20515)
(NASA-CR-69543) CFSTI: HC $6.00/MF $1.25 CSCL 14B

Techniques and developments in the design and fabrication of transducers that contain the necessary signal conditioning to output signals that are digital or can be easily converted to digital form are investigated. Computer controlled checkout system requirements which are pertinent to the area of transducer design and performance are reviewed. In particular, the digital compatibility factors are evaluated with a view toward assisting the selection of the most promising digital transducer techniques. A state-of-the-art survey, both of digital transducers and analog-to-digital conversion techniques, was conducted to provide a background both for deciding which techniques are applicable to checkout requirements and for deciding what design and operational characteristics are feasible at present and in the future. Special considerations necessary for conditioning and transduction of both low-level and high-level sensor signals are discussed. M.R.W.

N66-15798# Picatinny Arsenal, Dover, N. J.
A PHOTOGRAPHIC METHOD FOR THE DETERMINATION OF THE LOCATION OF THE CENTER OF GRAVITY OF SOLID BODIES
Eugene Nachlupins Oct. 1965 23 p
(PA-TR-3260; AD-473715)

It has been determined that the photographic method for the determination of the location of the Center of Gravity is fast, precise and reliable–permitting rapid adjustments of the design with resultant savings in development line of an item. Author (TAB)

N66-15809*# Kinelogic Corp., Pasadena, Calif.
TAPE RECORDER-REPRODUCER MECHANISM–WORST-CASE ANALYSIS Final Report

John Lueder, Irving Karsh, Graham Barr, and Robert Bruns Oct. 1965 110 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950903)
(NASA-CR-69563) CFSTI: HC $4.00/MF $0.75 CSCL 14C

A worst-case analysis was performed on three units of a tape recorder–reproducer mechanism in order to prepare functional design specifications. Available test data from all units were analyzed to determine the failures experienced and the corrective action taken. Considered were service load, strength of mechanical elements, reliability and life analysis, mean time before failure, and criteria for bearing performance in tape transports. Data pointed out the necessity to eliminate juvenile failure mechanisms and indicated the critical nature of the belts and bearings. The construction of a mathematical model for an iso-elastic tape drive and analog simulations with tape speed as the read-out parameter was found feasible. G.G.

N66-15819*# TRW Systems, Redondo Beach, Calif. Physical Electronics Lab.
VELOCITY SELECTOR FOR AN ELECTROSTATIC HYPERVELOCITY ACCELERATOR
D. O. Hansen Jul. 1965 10 p refs
(Contract NASw-936)
(NASA-CR-69574; STL-4158-6008-TU-000) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Described is a velocity selector system for an electrostatic hypervelocity particle accelerator that amplifies the output waves of the accelerator detectors, displays them on an oscilloscope, and photographs the tracings so that the parameters of the observed particles can be measured. A pulse height window discriminator on the output of the charge detector together with two velocity detectors are utilized to specify particle charge intervals and, respectively, particle velocity intervals. This simultaneous specification of charge and velocity, together with the known accelerator voltage, makes it possible to calculate the particle mass. G.G.

N66-15828*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONSTRUCTION AND EVALUATION OF A NUDE FAST-RESPONSE COLD-CATHODE IONIZATION GAGE
Alphonsa Smith and Leonard T. Melfi, Jr. Washington, NASA, Feb. 1966 32 p refs
(NASA-TN-D-3266) CFSTI: HC $2.00/MF $0.50 CSCL 14B

A nude cold-cathode gage has been employed as a means of measuring a sudden pressure increase from 10^{-6} torr to 10^{-3} torr. This report discusses the construction and evaluation of such a gage. An experimental gage was constructed to allow variation in the electrode material, gage geometry, and the electrical and magnetic fields. These parameters were varied to determine a suitable combination which would give linearity, sensitivity, and other operational characteristics. Response-time tests for an optimized experimental gage were made. These studies indicated a gage response time of less than 100 microseconds for a pressure increase from 10^{-6} torr to 10^{-3} torr. It is shown that the location of the gage in the vacuum chamber is important in effectively determining the response time histories. This gage can be employed in vacuum facilities where measurements of rapidly increasing pressures are to be obtained. Author

N66-15856# North American Aviation, Inc., Columbus, Ohio.
EVALUATION OF AN IMAGE QUALITY ENHANCEMENT TECHNIQUE Technical Report, Dec. 1962–Dec. 1964
Robert W. Brainard and Kenneth B. Caum Wright-Patterson AFB, Ohio, AMRL, Sep. 1965 102 p refs
(Contract AF 33(657)-9686)
(AMRL-TR-65-143; AD-624470) CFSTI: HC $4.00/MF $0.75

A technique for enhancing the quality of images was investigated. The technique consists of obtaining a video signal from a transparency and adding to this signal its negative second derivative. The technique was investigated by comparing human performance on images produced from the video signal and its derivative with images produced from the video signal alone. Four classes of images, defined by their content, were investigated: tactical, airfields, aircraft, and artificial 'C' forms. A variety of target detection, classification, and identification tasks were studied, and performance indices such as completeness, accuracy, and speed were calculated from the basic performance data. The results indicated that the enhancement technique produces both a statistically and a practically significant improvement in performance. The relative magnitude of the improvement increased as the difficulty of the performance task increased. The enhancement technique improves performance principally by increasing the number of correct responses, and to a lesser extent by reducing the number of incorrect responses. Author (TAB)

N66-15887# College of Aeronautics, Cranfield (England). Instrumentation and Automation Section.
POSITION TRANSDUCERS FOR NUMERICALLY CONTROLLED MACHINE TOOLS
C. J. Charnley and M. Healey Dec. 1964 32 p refs
(COA-Note-M&P-6) CFSTI: HC $2.00/MF $0.50

The paper covers the basic text book theory of all forms of position transducers used on commercial numerically controlled machine tools. Some attempt is made to categorize and indicate the scope and usage of these devices. The descriptions deliberately set out to explain this essentially electrical topic in a manner not requiring expert electrical knowledge. Author

N66-15926# Harry Diamond Labs., Washington, D. C.
A PIEZORESISTIVE SHOCK-PRESSURE TRANSDUCER
P. S. Brody and A. P. Raiche 30 Aug. 1965 35 p refs
(HDL-TR-1303; AD-624085) CFSTI: HC $2.00/MF $0.50

A shock-pressure spiral transducer has been fabricated and determined capable of measuring 30 kilobars or less shock pressure to ±6 percent. A spiral of manganin is imbedded in a Plexiglas or epoxy matrix that is oriented so that the plane of the spiral is parallel to that of a shock front, which is generated in the matrix by gas-gun accelerated metal plates. When the spiral carries a constant current, a voltage change proportional to the time-dependent pressure occurs as a result of the resistance change caused by the piezoresistive nature of manganin. The voltage outputs produced in tests utilizing 30-kilobar pressure steps verify the calculated response time of approximately 10^{-7} sec and yield an effective piezoresistive coefficient for shock pressures in Plexiglas of 2.85 ± 0.00017 ohms/ohm kilobar. The deviation is a measure of the spread from transducer to transducer. This report describes the imbedding procedure, circuits for measuring the resistance change, the calculated theoretical response of the transducer, the method used to produce the shock waves, and the experimental results obtained in shock-wave measurements.
Author (TAB)

N66-15953# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
THEORETICAL AND EXPERIMENTAL RESULTS FOR THE DYNAMIC RESPONSE OF PRESSURE MEASURING SYSTEMS

H. Bergh and H. Tijdeman Jan. 1965 24 p refs Submitted for Publication
(NLR-TR-F.238) CFSTI: HC $1.00/MF $0.50

A method is presented to predict theoretically the dynamic response characteristics of pressure measuring systems consisting of thin tubes connected to a pressure transducer. The influence of the different parameters has been demonstrated and comparisons with experiments are given which show an accurate agreement. Author

N66-15954# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
A RECORDING MICROBALANCE FOR REMOTE THERMOGRAVIMETRIC EXAMINATION OF IRRADIATED MATERIALS
K. T. Harrison and K. T. Scott Jun. 1965 28 p refs
(AERE-R-4962) HMSO: 4s 6d

An assembly is described for the adaptation of a recording microbalance for the thermogravimetric investigation of the oxidation of irradiated uranium dioxide in a preferred form. A 4" lead shielding system is employed, enabling specimens up to 20 mg in wt. and about 1 MeV Curie in activity to be examined. A description of the operating procedure and the results of trial runs is also given. The system could be used for any irradiated material in the form of small (10 to 1000μ) spheroids or chips. Author

N66-15955# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A MICROSECOND-RESPONSE-TIME PRESSURE SYSTEM AS APPLIED IN SHOCK TUNNEL AERODYNAMIC TESTING
Clarence J. Harris and Bernadette L. Maguire Oct. 1965 44 p refs Presented at 1965 Aero Space Tech. Conf. and Exhibit, Houston, June, 1965
(AF 04(647)-617)
(R65SD54; AD-473877)

Work is discussed on the development of a microsecond response-time pressure measuring system. This system was required in order to obtain reliable experimental transient surface pressure data on models during a special test program, a shock-on-body study conducted in the Hypersonic Shock Tunnel. Particular characteristics of the shock tunnel test program are discussed briefly in order to define the specifications (electronic and mechanical) which the pressure measuring system had to meet. System design and evaluation details are presented for the developed pressure measuring system. Shock tunnel model surface transient-pressure data are presented which were obtained with this developed system from the shock-on-body study. Author (TAB)

N66-15997# National Physical Lab., New Delhi (India). Radio Propagation Unit.
A SOLAR RADIOMETER AT 2000 MC/S Scientific Report No. 21
N. V. G. Sarma and M. N. Joshi 15 Jun. 1965 29 p refs
(RPU-S21) CFSTI: HC $2.00/MF $0.50

The report describes a radiometer which operates at a frequency of 2000 Mc/s and is used for regular measurement of radio flux at a wavelength of 15 cm. The antenna used is an equatorially mounted parabolic dish of 1.6 meters diameter fed by a circular wave guide. The energy collected by the antenna is taken to a conventional type of broadband mixer in a strip line form using a 1N21F mixer diode. The 30 Mc/s intermediate frequency is first amplified by a low noise transistorized IF amplifier and then by a high gain post IF amplifier. The overall bandwidth of the system is 5.3 Mc/s. The rectified signal is further amplified by a dc amplifier which drives a pen recorder. A free space impedance box has been used for the accurate calibration of the system. Author

N66-16034# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
SEMICONDUCTOR TRANSDUCERS FOR ULTRASONIC TESTING
Otto R. Gericke Sep. 1965 23 p ref
(AMRA-TR-65-21; AD-623835) CFSTI: HC $1.00/MF $0.50

A new type of ultrasonic transducer is discussed which employs a semiconductor crystal as the active element. Experiments are reported in which germanium and silicon crystals were used as transmitters and receivers of ultrasonic signals. The sensitivity of the semiconductor transducer is compared with piezoelectric transducers and ordinary capacitive probes employed under identical conditions. The semiconductor transducer is found to have a lower sensitivity than the piezo-electric transducer but it offers the advantages that it does not require a couplant and can be provided with a sharp point to permit testing on very rough surfaces. Author (TAB)

N66-16060# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
O.N.E.R.A. DYNAMOMETERS 20N70 AND 20N79 FOR FORCES BETWEEN 250 daN AND 10.000 daN [DYNAMOMETRES O.N.E.R.A. 20N70 A 20N79 GAMME DE 250 daN A 10.000 daN]
Pierre Broussaud 1965 22 p In FRENCH; ENGLISH summary
(ONERA-TN-84) CFSTI: HC $1.00/MF $0.50

For its own needs and for those of government organizations, O.N.E.R.A. has designed, built and calibrated a certain number of dynamometers and those in the series 20N70 to 20N79, described in this note, deal with forces between 250 daN and 10000 daN. These dynamometers consist essentially in a central part equipped with strain-gages and placed between two decouplers. The description and the information given aim at facilitating the utilization of this equipment. Author

N66-16068*# National Research Corp., Cambridge, Mass.
STUDY OF DENSITY CALIBRATION IN SPACE Final Report, 18 Jun. 1964-18 Aug. 1965
F. Feakes and F. J. Brock Nov. 1965 33 p
(Contract NAS5-3959)
(NASA-CR-69692) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Details are given on the design, construction, and experimental evaluation of an in-flight calibration system for satellite mass spectrometers and pressure gauges. The system consisted of a controlled pressure hydrogen storage volume with provisions for vacuum degassing, the hydrogen diffuser, the diffuser internal heater, an ion gauge, a restrictive conductance of known value, and an ultrahigh vacuum system. Test data from the Mark I prototype were incorporated into a second generation Mark II prototype to improve performance characteristics. Results indicate the feasibility of a gauge calibration method based on the addition of controlled throughputs of gas to a gauge which is tubulated to a pumping system by a restrictive conductance. It was also shown that controlled throughputs of gas can be obtained by using temperature variations to change the permeation rate of hydrogen through a thin-walled stainless steel tube. However, tests of the Mark II show

that improvement is desirable in both the low pressure background and in the rate of pressure decrease after calibration at 1×10^{-7} torr. The Mark III was designed to achieve this improvement; further experimental evaluation is recommended. M.G.J.

N66-16076*# Franklin Systems, Inc., West Palm Beach, Fla.
SCINTILLATION TYPE NUCLEAR DENSITOMETER, MODEL 143A. HIGH COUNTING RATE, SCINTILLATION TYPE NUCLEAR DENSITOMETER, MODEL 143 B. EVALUATION OF PRECISION GAMMA RADIATION DENSITOMETER TECHNIQUES FOR CRYOGENIC LIQUIDS Final Report
31 Dec. 1963 179 p refs
(Contract NAS8-13)
(NASA-CR-69709) CFSTI: HC $5.00/MF $1.00 CSCL 14E

Various nuclear radiation detectors were evaluated with the objective to develop a more accurate and reliable detector to replace the scintillation counters presently used for liquid oxygen and hydrogen densitometry. Studied were the characteristics, design, and performance of ionization chambers, solid state detectors, proportional counters, geiger counters, as well as nuclear densitometers utilizing gamma radiation attenuation when passing through the liquid to obtain the mass absorption coefficient. A densitometer with a cesium 137 energy source seems feasible for liquid hydrogen measurements, and a densitometer with the more penetrating energy beam from a cobalt 60 source can be used to obtain attenuation measurements for liquid oxygen. G.G.

N66-16093# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.
MAGNETIC RECORDING SYSTEMS FOR NEUTRON TIME-OF-FLIGHT EXPERIMENTS
J. W. Hall Nov. 1964 37 p refs
(AERE-NP/GEN/26)

This paper discusses the use of magnetic tape for various time of flight experiments. A prototype tape recording system providing 400 time channels is described. It is shown that the method is immediately adaptable to a 64,000 channel spectrometer. The method is extended logically and a very simple and cheap spectrometer using a magnetic drum is proposed to provide a small number of channels. This system is especially suitable for chopper experiments. Appendices deal with the effects of errors introduced by the use of tape and measurements of the number of pulses lost when recording is used. Some of the measurements discussed are applicable to several time-of-flight analysers built since 1957. Author

N66-16095# Federal Aviation Agency, Atlantic City, N. J. Evaluation Div.
EVALUATION OF THE ASR VIDEO PHOTOGRAPHIC RECORDING TECHNIQUE Final Report
Gerald E. Titherington Aug. 1965 40 p
(RD-65-99)

The requirement for a practical means of recording air traffic history as derived from radar displays resulted in an evaluation of the photographic technique described in this report. The purpose of the evaluation was to determine whether the technique was suitable for recording radar video data and whether the photographic record was adequate for subsequent re-creation of an air traffic situation. Data were obtained by photographing radar presentations at the John F. Kennedy Tower facility during periods of high air traffic activity. Reconstruction of the traffic situations using these photographic records was accomplished by air traffic controllers. Results of data analysis showed that the photographic technique incorporating particular equipments and procedures was suitable for recording radar video data and was adequate for re-creating air traffic situations. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N66-15228*# Hittman Associates, Inc., Baltimore, Md.
THERMOELECTRIC BONDING STUDY
Abraham L. Eiss Washington, NASA, Jan. 1966 62 p refs
(Contract NAS5-3973)
(NASA-CR-389) CFSTI: HC $3.00/MF $0.75 CSCL 13H

A study was made to determine the bonding process and the mechanism of bond failure in lead telluride thermoelectric elements; and to develop a braze and shoe system, preferably with nonmagnetic materials. Tin telluride, which was found to be the braze having the least effect on the thermoelectric properties of lead telluride, was selected for study of bonded elements. A bonding process was developed; and a number of elements were evaluated metallographically by bond resistance measurements and torque tests. Stress analyses identified the principal thermal stress patterns in bonded thermoelements. It is concluded that there are many shoe materials to which lead telluride can be bonded, but in most cases these bonded elements will not survive or perform adequately for extended periods. Principal causes of failure is poisoning by diffusion of material from the braze or shoe into the thermoelectric material and thermal stresses at the bond interface. A promising braze for jointing PbTe to iron shoes is SnTe or SnTe modified by Ti, but the life tests of such systems must be undertaken. M.W.R.

N66-15241*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
IN-FLIGHT TEST TO DETERMINE SPACE ENVIRONMENTAL EFFECTS ON FRICTION, WEAR, AND LUBRICATION OF MATERIALS
Harold E. Evans and Edward J. Devine [1965] 15 p Presented at the AIAA 2d Ann. Meeting and Tech. Display, San Francisco, 26–29 Jul. 1965 Submitted for Publication
(NASA-TM-X-54967) CFSTI: HC $1.00/MF $0.50 CSCL 13H

Measurement of rolling and sliding friction and cold welding effects in orbit is the purpose of a proposed experiment designed on a modular basis. The modules, which may be combined as necessary to fit the final space and power available in the spacecraft include: (1) a bearing test module to test eight instrument bearings under load and to measure torque and time to failure; (2) one to three friction and wear test modules to make measurements of six different combinations of materials; and (3) a pressure transducer to measure total pressure in the vicinity of the experiment. Several illustrations of the modules are included. M.W.R.

N66-15243*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FLUORIDE SOLID LUBRICANTS FOR EXTREME TEMPERATURES AND CORROSIVE ENVIRONMENTS

Harold E. Sliney, Thomas N. Strom, and Gordon P. Allen Washington, NASA, 1964 37 p refs Presented at the 20th Ann. Meeting of the Am. Soc. of Lubrication Engr., Detroit, 4–6 May 1965
(NASA-TM-X-52077) CFSTI: HC $2.00/MF $0.50 CSCL 11H

Fluorides of the alkali metals and the alkaline earth metals have an interesting combination of properties that make them promising candidates as solid lubricant materials for use at high temperatures and in corrosive environments. They are chemically inert in strong oxidizing or reducing environments; they are relatively soft and nonabrasive; and some of them, such as CaF_2, have planes of perfect cleavage in their crystal structure suggesting low shear strength and good friction properties. Thin, fused fluoride coatings (0.001 in.) were applied to nickel–chromium alloys by spraying water slurries of the fluorides on the bearing surface, drying, then firing in a hydrogen atmosphere. Coatings of CaF_2–LiF mixtures and of CaF_2–BaF_2 mixtures were effective as solid lubricants in hydrogen to 1500° F and in air to 1200° F. CaF_2–BaF_2 coatings were effective solid lubricants in liquid sodium at 1000° F and a sliding velocity of 2000 ft/min. Author

N66-15364*# Martin Co., Baltimore, Md.
LUNAR ROCK CORING DEVICE DESIGN STUDY Final Report
Donald S. Crouch Oct. 1965 197 p refs
(Contract NAS9-3542)
(NASA-CR-65188; ER-13952) CFSTI: HC $5.00/MF $1.25 CSCL 13I

A study of rock coring techniques applicable for lunar surface operation within the constraints of early LEM missions resulted in the selection of a rotary-percussion system employing tungsten–carbide core bits. Fabrication of a breadboard model and subsequent evaluation tests demonstrated that 12 feet of consolidated rock core can be obtained without gaseous or liquid lubrication and hole flushing agents which are always employed with commercial drilling equipment. Parallel studies were conducted to the degree required for specifying the design and specifications for a coring device which can be operated in the lunar environment. Author

N66-15366*# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
SUPERSONIC TRANSPORT LUBRICATION SYSTEM INVESTIGATION Second Semiannual Report
C. G. Hingley and L. B. Sibley 20 Nov. 1965 125 p refs
(Contract NAS3-6267)
(NASA-CR-54312; SKF-AL65T077) CFSTI: HC $4.00/MF $1.00 CSCL 13I

Ball bearings and bellows face seals for use on Mach 3 aircraft gas turbine engine mainshafts, and suitable test rigs to simulate engine operating conditions, have been manufactured and check-out testing conducted on all hardware and test systems. A development program is underway to determine the most suitable combination of presently available materials and lubricants to permit operation of these bearings and seals under typical engine load and speed conditions at the highest possible ambient temperature above 600° F with the seals exposed to 1200° F air and a pressure differential of 100 psi. Tests are conducted primarily using a nitrogen-blanketed bearing chamber and lubricant system. Test lubricants are being screened for their potential performance under two different application techniques, namely, jet lubrication of the bearings with circulating oil, and once-through lubrication in the form of oil mist. Author

N66-15374*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
MATERIALS FOR POTASSIUM LUBRICATED JOURNAL BEARINGS Quarterly Progress Report No. 8, 22 Jan.–22 Apr. 1965
R. G. Frank, ed. [1965] 221 p refs
(Contract NAS3-2534)
(NASA-CR-54646) CFSTI: HC $8.00/MF $1.25 CSCL 13I

Data from the corrosion, dimensional stability, thermal expansion, and hot hardness test programs were reviewed to select material combinations for friction and wear testing in high vacuum and in liquid potassium. Evaluation of corrosion test specimens exposed to potassium for 1000 hours at 1600°F was completed. Preparation of metallographic specimens, X-ray diffraction patterns, and chemical analyses for carbon, oxygen, nitrogen, and hydrogen were completed and the results are being analyzed. A second series of hot hardness tests from room temperature to 1600°F were completed under vacuum for all candidate bearing materials. Checkout tests for the high vacuum friction and wear tester were continued. Procedures for tearing out the loading arm were established, the temperature distribution achieved from the bakeout heaters was determined, and the vacuum capability of the system was established. The potassium wetting facility is nearing completion. R.N.A.

15

N66-15479*# Franklin Inst., Philadelphia, Pa. Research Labs.
A BIBLIOGRAPHY (WITH ABSTRACTS) ON GAS-LUBRICATED BEARINGS Interim Report
Alec Peters and Patricia Devlin Nov. 1965 232 p refs Sponsored in part by NASA and AEC
(Contract Nonr-2342(00))
(NASA-CR-69394; I-A2049-25) CFSTI: HC $6.00/MF $1.25 CSCL 13I

The compilation presented in this bibliography has been prepared as a literature survey in support of an experimental and development program of research on gas lubricated bearings. The bibliography is a continuation of a similar work issued in October 1961. It contains 493 abstracts. It covers the magazine, book, periodical technical report and patent literature, both domestic and foreign. Most of the abstracts are either author's or author modified type. It is arranged in chronological order from January 1961 through December 31, 1964, according to the date of publication. The first two digits of the five digit number of each reference indicate the year. Some 55 sources, which were not recorded in the previous bibliography, are also abstracted. The bibliography is provided with an author index (corporate and individual), subject index and patent index. Author

N66-15545*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N. Y.
HIGH TEMPERATURE HYDRAULIC SYSTEM ACTUATOR SEALS FOR USE IN ADVANCED SUPERSONIC AIRCRAFT First Semiannual Report
J. Lee 14 Oct. 1965 76 p refs
(Contract NAS3-7264)
(NASA-CR-54496; FHR-2702-1) CFSTI: HC $3.00/MF $0.75 CSCL 11A

This report covers the first six-month period of a program to investigate seal materials and to design seals for high temperature hydraulic actuator application. In pursuing these objectives, work has progressed in the areas of test fixture design and fabrication, materials selection, materials evaluation, seal design, and preliminary seal testing. Results of the initial fluid-material compatibility tests conducted with the F-50, MCS-3101, MCS-293, MLO-60-294, and PR-143AB fluids

were inconclusive because of cross contamination of fluids between test manifolds. Five rod seal designs are currently being developed. The seal configuration fabricated of a polyimide (Polymer SP) plastic has been evaluated at 400°F, 500°F, and 600°F, with promising results. Author

N66-15688# United Kingdom Atomic Energy Authority, Harwell (England).
PILOT-SCALE ELECTRON-BOMBARDMENT FURNACE AND CONTINUOUS CASTING. APPLICATION TO THE TRIAL PREPARATION OF 20 kg OF URANIUM MONOCARBIDE RODS
J. Trouve, R. Genard, A. Treillou, and A. Accary 1965 40 p ref Transl. into ENGLISH from Rept. CEA-R-2587, Aug. 1964 (AERE-TRANS-1033; CEA-R-2587) HMSO: 7s

A pilot scale electron beam furnace designed for continuous melting and casting of uranium–carbon alloys is described. This equipment allows the melting and casting processes to be completely automatically controlled, the cooling being carried out under vacuum and the discharge being effected without breaking the vacuum. In a pre-production run of 20 kg of slugs, the composition of practically all the pieces was controlled within ±0.1 percent C. The output of the furnace was 2.2 kg/hour. Author

N66-15726*# National Research Corp., Cambridge, Mass.
DEVELOPMENT OF TECHNIQUES AND HARDWARE FOR INSULATION WRAPPINGS OF CRYOGENIC CONTAINERS Eighth Quarterly Progress Report, Aug.–Oct. 1965
Malcolm E. Reed Dec. 1965 13 p
(Contract NAS8-11042)
(NASA-CR-69538) CFSTI: HC $1.00/MF $0.50 CSCL 13H

During this report period most of the work was directed towards completing drawings for the fabrication and assembly of the superinsulation system. A design for the purge bag was conceived. The calculations for determining the optimum number of layers resulted in a value of 54 layers to yield the minimum ratio of non-useful to useful weight. Author

N66-15757# Naval Ordnance Test, Station, China Lake, Calif.
EX POST FACTO RELIABILITY CONSIDERATIONS
Herbert H. Blackschleger Oct. 1965 17 p refs
(NOTS-TP-3716; AD-622428) CFSTI: HC $1.00/MF $0.50

This report describes the basic considerations of an effective and comparatively low-cost reliability program for an exemplary airborne missile. It covers cases where expediency precludes full reliability considerations prior to production go-ahead and where the manufacturer has accepted a contractual requirement to demonstrate reliability at the systems level. It apportions reliability requirements, delineates important procedures that will provide worthwhile reliability assurance at reasonable cost, and fits the program into the quality assurance provisions of a typical manufacturer oriented to military contracts. The program is intended for missiles that are produced in small quantities. Author (TAB)

N66-15767*# IIT Research Inst., Chicago, Ill.
ENVIRONMENTAL STUDY OF MINIATURE SLIP RINGS Quarterly Report No. 9, 1 Jul.–1 Oct. 1965
O. M. Kuritza [1965] 16 p
(Contract NAS8-5251)
(NASA-CR-69540; E6000-28) CFSTI: HC $1.00/MF $0.50 CSCL 13E

Objectives were to evaluate slip ring materials suitable for operation in high vacuum. A description of the high vacuum facility and the testing procedures used are reported. Tests proved the necessity of using vacuum bearings in the capsule and in the drive apparatus. New brush-ring assemblies using materials with good off-gassing properties were fabricated. Run-in tests of a new brush design were conducted in a nitrogen atmosphere. Mass spectrometer studies of the off-gassing products of materials used in the brush-ring assemblies were started. An investigation of methods for lubricating slip ring assemblies was initiated. M.R.W.

N66-15780# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON AUTOMOTIVE TECHNOLOGY [AUTOMOBIELTECHNIEK LITERATUUROVERZICHT]
16 Oct. 1965 34 p refs In DUTCH, ENGLISH, and GERMAN *Its* Vol. 1, No. V-3
CFSTI: HC $2.00/MF $0.50

An annotated bibliography on automotive technology is presented. Descriptions and design specifications of various trucks, amphibious landing vehicles, bulldozers, and commercial vehicles are reported. Studies on braking, ignition, engine, suspension, and electrical systems are summarized. Reference is given to recent developments in automotive tires and safety glass. Also reported are computer programs to determine the relationship between pressure flow, heat release, and thermal load in diesel engines. A report on computer simulation of the automobile driver is also included. M.R.W.

N66-15815*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Florida Research and Development Center.
RESEARCH AND DEVELOPMENT OF MATERIALS FOR USE AS LUBRICANTS IN A LIQUID HYDROGEN ENVIRONMENT Final Report, Jul. 1964–Nov. 1965
W. H. Rempe and W. E. Young 29 Oct. 1965 69 p
(Contract NAS8-11537)
(NASA-CR-69569; PWA-FR-1602) CFSTI: HC $3.00/MF $0.75 CSCL 13H

The objective of the program was to develop materials for use as lubricants in rolling-element bearings operating in a liquid hydrogen environment at DN levels up to 4.0×10^6 mm-rpm. In the first phase, the results of which were previously reported, 10 candidate lubricant materials were selected and evaluated in a ball-plate test apparatus. In the second phase, 10 additional materials were evaluated, and from the 20 candidates, the four most promising were selected for testing in actual 80-mm bearings at speeds up to 50 000 rpm. Author

N66-15822*# Harvey Aluminum, Torrance, Calif. Harvey Engineering Labs. for Research and Development.
RESEARCH PROGRAM TO DEVELOP A TECHNOLOGY IMPROVEMENT PROGRAM FOR CLOSED DIE FORGING Progress Report No. 4, Sep.–Nov. 1965
J. R. Long Dec. 1965 94 p
(Contract NAS8-20093)
(NASA-CR-69572; HA-2203) CFSTI: HC $3.00/MF $0.75 CSCL 13H

The objective of this project is to develop advanced die forging techniques that are applicable to producing more sophisticated and closer tolerance shapes from high strength space material such as 7075 aluminum alloy, 8Al–1Mo–1V titanium alloy, and maraging steel. This report discusses the drawings for the dies designed for this project and considers a series of preliminary test runs made on flat dies with aluminum alloy 7075. Author

N66-15825*# Hughes Tool Co., Houston, Tex. Research Dept.
PRELIMINARY DESIGN OF A GEOLOGIC SAMPLE ACQUISITION AND TRANSPORT DEVICE Final Report, May–Oct. 1965
W. T. Jones and R. O. Bredthauer Oct. 1965 204 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951178)
(NASA-CR-69577) CFSTI: HC $6.00/MF $1.25 CSCL 13I

A concept design for a breadboard model of a geologic sample acquisition and transport device is described. This device will take a three cubic centimeter sample of rock from under a twelve inch layer of overburden and transport the sample, uncontaminated by the overburden, to a point above the overburden surface and deposit it in a tray for subsequent analysis. The overburden may also be similarly sampled. The device is designed to acquire overburden and rock samples through ports to the interior of the rotary-impact bit, to seal the bit interior by rotary valving, and to transport the batch sample to the surface by means of a gas system. An outer barrel provides a means of excluding overburden during rock sample acquisition. The approach taken in the generation of concepts and development of the design is described, and the original concepts along with investigations and evaluations are included in an appendix. Author

N66-15846*# Martin Co., Baltimore, Md.
SATURN HELIUM BOTTLES
R. A. Hirsch Oct. 1965 34 p refs
(Contract NAS8-11555)
(NASA-CR-69618; ER-14012) CFSTI: HC $2.00/MF $0.50 CSCL 13H

Activities associated with the production of high pressure helium storage bottles for the Saturn S-IC are reported. Also reported is the ultimate solution to problems relative to the production process. Revisions in the final production bottles are discussed, and include hardness acceptance criterion, the addition of more control thermocouples, and the addition of test bars placed inside the bottle. Discussions associated with fabrication include machining of extrusions, forming of the ends, internal machining of the ends, heat treatment, internal shot peening, surface finishing, acceptance testing, and contamination control cleaning. C.T.C.

N66-15871# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON MANUFACTURING TECHNOLOGY [LITERATUUROVERZICHT WERKPLAATSTECHNIEK]
Oct. 1965 31 p refs In DUTCH, GERMAN, FRENCH, and ENGLISH *Its* Vol. 10, No. W-91 CFSTI: HC $2.00/MF $0.50

A compilation of abstracts is presented of literature on manufacturing technology. Major areas covered are stressed operations, operations without tension (or stress), and manufacturing techniques. These include such topics as cutting and stressing tools, broaching and filing, grinding, and pressing. C.T.C.

N66-15888# Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
HAZARDS OF PNEUMATIC TRANSPORT OF SOLID EXPLOSIVES
D. K. Heere, F. T. Kristoff, D. Smith, and R. H. Richardson [1965] 48 p refs Presented at the Armed Serv. Explosives Safety Board 7th Ann. Explosives Safety Seminar, Cocoa Beach, Fla., 24–26 Aug. 1965
(ABL/Z-84)

This paper presents the results of an investigation of the hazards involved in pneumatically transporting solid explosive materials. Consideration is given to the theory of pneumatic transport and the effect of flow parameter variations on transport conditions. Experimental data are presented to substantiate the theoretical considerations and to define previously uninvestigated parameter interrelations. The factors considered are particle size and shape, material flow density, transfer line size, acceleration distance and mode of particle flow. The sensitivity and reaction of explosive materials to the forces and energies encountered during pneumatic transport are discussed. Factors of prime importance considered are initiation of material by impingement with transport system components or by inter-particle collision, the transition to explosive reaction through initiation of secondary reaction in dust-laden atmospheres, and the generation of explosive dusts. Methods of reducing hazards, such as modifying the system design, setting operating limits, and using inert atmosphere are considered. Author

N66-15919# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
RECENT DEVELOPMENTS IN NONVACUUM ELECTRON BEAM WELDING
J. W. Meier [1964] 22 p Presented at the Intern. Conf., Electron and Ion Beam Sci. and Technol., Toronto, 6 May 1964 (TP-64-04)

The basic technical problems in nonvacuum electron beam welding are discussed and the results of experimental testing to determine the effects of nonvacuum electron beam welding parameters and to evaluate the state-of-the-art of welding capabilities are reported. Results show that welds produced by this process are quite similar to those produced by vacuum electron beam welding and that these welds have excellent properties. The nonvacuum electron beam welding technique has the advantages that no large or complex work chambers and vacuum systems are required and that high-speed, high production processing is greatly simplified. The process has the disadvantage that the working distance below the gun structure is somewhat limited, restricting the shape of the workpiece being welded and also preventing welding in inaccessible areas. Potential areas of application of the process include the fabrication of thin and heavy-walled tubing, metal containers, missile cases, ship structures, and automotive parts. In general, any component requiring high-quality welding at high speed and having a reasonably smooth contour which permits access of the beam exit orifice close to the weld joint is considered a candidate for this process. E.E.B.

N66-15928# Naval Research Lab., Washington, D. C.
AN INVESTIGATION OF BARRIER COATINGS ON GRAPHITE MOLDS FOR CASTING TITANIUM
W. A. Reaves and E. J. Chapin 13 Oct. 1965 43 p refs
(NRL-6295; AD-623992) CFSTI: HC $2.00/MF $0.50

The coatings included: a solid solution of MgO and ZrO_2; a true oxide compound, $CaZrO_3$; and two single oxides, Gd_2O_3 and Y_2O_3. The compound oxides were applied to specially cleaned ATJ grade graphite-mold hollow cylinder inserts by an oxy-acetylene flame spray method, and the single oxides were applied in similar inserts by a plasma spray technique. The MgO, ZrO_3 and $CaZrO_3$ coatings were considered to be insufficiently resistant under casting conditions to qualify as satisfactory barrier coatings. The rare earth oxide Gd_2O_3 was found to be resistant to molten titanium during casting and to provide a good barrier between the graphite mold substrate and the cast metal, with no significant increases in either oxygen or carbon content. The oxide Y_2O_3 was found to have the best characteristics as a barrier coating.

This oxide did not appear to be wetted by the molten metal cast against it nor to introduce any significant amounts of contaminants into the case metal. The barrier coatings were not effective in altering the high heat extraction capability of the graphite substrate and thus did not provide any improvement in solidification center line shrinkage. Author (TAB)

N66-15974*# North American Aviation, Inc., Los Angeles, Calif.

EXPERIMENTAL TITANIUM CROSSBEAM MANUFACTURING TECHNOLOGY Final Report, 1 Jul. 1964–30 Oct. 1965

12 Nov. 1965 129 p refs

(Contract NAS8-11768)

(NASA-CR-69649; NA-65-947) CFSTI: HC $4.00/MF $1.00 CSCL 13H

The objective of this program was to develop advanced manufacturing technology applicable to production of large titanium alloy structures. In order to achieve minimum weight in the Saturn V vehicle, new structural concepts were proposed which utilize the improved stiffness-density of recently developed titanium alloys. The specific goal of this program was to design and fabricate a titanium crossbeam assembly with load-carrying capability equivalent to the current aluminum alloy center engine supports used in the Saturn V boosters. Preliminary analyses had indicated that a weight reduction of approximately 30 percent could be achieved by the use of a unique sine wave configuration developed by NAA for supersonic military airframe applications. During the course of the program, design and manufacturing development resulted in achievement of 37.8% weight reduction. Additional items were also outlined, resulting in an anticipated total of 40% weight reduction for the proposed material/design application in comparison with the basepoint aluminum structure. The sine wave beam concept is similar to the familiar "I" beam except that the web is a modified sine wave. Heavy cap members are welded to the sine wave web by a special burn-through TIG welding process. The program verified the producibility aspects of the material/design concept of titanium sine wave beam structures, and indicated potential cost reductions, in comparison with the basepoint aluminum crossbeam, as well as major weight reductions. Author

N66-15986*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.

SEMICONDUCTOR WAFER IMPROVEMENT THROUGH PHOTOENGRAVING Final Report, 1 Mar.–1 Jul. 1965

C. J. Taylor [1965] 35 p

(Contract NAS5-3758)

(NASA-CR-69678) CFSTI: HC $2.00/MF $0.50 CSCL 13H

This investigation discusses the use of Kodak metal etch resist as a silicon dioxide masking agent. The photoengraving process is described such that the results achieved can be duplicated. Process capability is described in terms of good resolution, good etch resistance, and pinhole count. Amoco 18 which is an additive to the resist and dipropyl carbonate, a new developer, were examined to determine their effects on the process. Amoco 18 was found to have little effect. Dipropyl carbonate improved the resolution of the resist from 100 lines per millimeter to 200 lines per millimeter. Resist exposed in vacuum printing was found to be thicker than resist exposed by mechanical contact pressure. An adjustment in resist thickness to give equal resolution created more pinholes in the vacuum exposed resist than could be expected in the mechanically contacted resist. Author

N66-15987*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.

PHASE III OF GROOVE ETCH STUDIES, OXIDE BARRIER ISOLATION Final Report, 1 Feb.–1 Jun. 1965

G. W. Skouson [1965] 32 p refs

(Contract NAS5-3758)

(NASA-CR-69679) CFSTI: HC $2.00/MF $0.50 CSCL 13H

The object of this report is to summarize controlled groove etching, chemical deposition of silicon dioxide and polycrystalline silicon in these grooves, as well as a report on the construction of oxide isolated regions of single crystalline silicon of a quality suitable for device manufacture. A process whereby these isolated regions may be fabricated is given. Essentially, the process followed is one which produces clean contaminant-free oxide barrier isolated regions. The method is compatible with existing processes of producing functional electronic blocks. Author

N66-15988*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.

EPITAXIAL PROCESS FOR DEVELOPMENT FOR MONOLITHIC COMPLEMENTARY MOS-FET STRUCTURE WITH OXIDE BARRIER ISOLATION Final Report, 15 Mar.–15 Sep. 1965

G. W. Skouson [1965] 29 p refs

(Contract NAS5-3758)

(NASA-CR-69680) CFSTI: HC $2.00/MF $0.50 CSCL 13H

This report summarizes the results of work done on experiments to provide oxide barrier isolation between areas of different conductivity type silicon. These areas are suitable for use in manufacturing complimentary MOS-FET devices. The process is essentially a combination of the groove-refill, and the oxide isolation processes developed and explained in prior reports. A process is provided along with specifications and directions whereby these results may be evaluated and/or duplicated. Photos and diagrams are provided to show typical results obtained. Author

N66-16058*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF IMPREGNATED LUBRICANTS IN BALL-BEARING RETAINERS AT 10^{-6} TORR

L. Dale Smith, Dean C. Glenn, and Herbert W. Scibbe Washington, NASA, Feb. 1966 21 p refs

(NASA-TN-D-3259) CFSTI: HC $1.00/MF $0.50 CSCL 13I

Four liquid lubricants, a polyphenyl ether, polysiloxane, a sebacate, and a high-viscosity mineral oil, were evaluated as lubricating impregnants in cotton-cloth phenolic retainers of 20-millimeter-bore ball bearings operating in a vacuum of 10^{-6} torr. The effect of the cloth weave on the lubricating effectiveness of the best of the lubricants was also studied. The test bearings were run at 3550 rpm under axial loads of 50 to 100 pounds (22.7 to 45.4 kg) for 1 hour, or until the torque exceeded and remained above 20 inch-ounces (14.1 cm-N). Although none of the lubricants provided good lubrication in the vacuum environment of this system, the most acceptable lubricant was the mineral oil. It provided the lowest torque levels and torque roughness and carried the maximum load for the full duration of the test. High initial torques occurred frequently with all of the lubricants, which indicated inadequate lubrication during the initial part of the run. Comparing bearing performance obtained with only impregnated retainers to that obtained with both impregnated retainers and prelubrication showed that the impregnated retainers used did not feed the lubricant fast enough to provide good lubrication

at the conditions of this investigation. In additional tests with the high-viscosity mineral oil, varying the weave of cloth in the retainer produced no significant improvements in the bearing torque. Author

N66-16067*# Progressive Welder and Machine Co., Pontiac, Mich. Special Machine Div.
STUDIES OF "SOFT TOOLING" FOR A SEMI-TOROIDAL TEST TANK] Final Report
Carl H. Baum 15 Oct. 1965 7 p
(Contract NAS8-11787)
(NASA-CR-69693) CFSTI: HC $1.00/MF $0.50 CSCL 13H

The decision that the soft tooling approach for the semi-toroidal test tank was not feasible is reported. It was also mentioned that although the tooling design which was performed represented solutions to novel production problems, the tooling itself was based on previous concepts of locating and clamping components which had proved workable. M.G.J.

N66-16158*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIMULATION OF THE J-2 ENGINE GIMBAL BEARING
K. E. Demorest and K. W. Wilks 20 Jan. 1966 23 p refs
(NASA-TM-X-53379) CFSTI: HC $1.00/MF $0.50 CSCL 11H

A test apparatus, designed to simulate the operation of the J-2 engine gimbal system, was used to test the J-2 gimbal lubricant at atmospheric pressure, at 10^{-6} mm of Hg, and over a wide range of temperatures. The currently specified gimbal lubricant, Fabroid consists of woven glass and Teflon fibers bound together with a phenolic resin. The Fabroid lubricant provided a low and constant coefficient of friction both at atmospheric pressure and at 10^{-6} mm of Hg at loads to 25 000 psi as long as the ambient temperature remained constant. However, the coefficient of friction of Fabroid was shown to be temperature dependent, increasing sharply with reducing temperatures. Although no experimental evidence indicated any degradation, the lubricating characteristics of Fabroid under high bearing loads had a tendency to fray and shed fibrous material. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N66-15605# Raytheon Co., Wayland, Mass. Advanced Development Lab.
LASER PUMPING TECHNIQUES STUDY Final Report, 1 Oct. 1964–30 Sep. 1965
Paul A. Silberg 30 Oct. 1965 72 p refs
(Contract AF 49(638)-1420)
(AFOSR-65-2212; AD-623848) CFSTI: HC $3.00/MF $0.75

In the course of the study of laser pumping techniques, Raytheon developed a reliable calorimeter technique to measure the transfer efficiency of the θ pinch in coverting capacitively stored electrical energy to electromagnetic energy. It is shown, with the use of circuit measurements, that the efficient θ-pinch circuit decay consists of a two-stage circuit decay and that the inefficient θ pinch consists of a three-stage decay. Using the circuit decay data, a modified transfer efficiency measurement for a two-stage plasma circuit was developed that is approximately as accurate as the calorimeter technique, but very much faster and easier to make. These measurements have been used to evaluate the transfer efficiency of the θ-pinch in Argon at pressures of 2 and 5 Torr with different tube sizes and with different coupling impedances. Measurements have shown a transfer efficiency as high as 59% with present measurements. Spectral measurements show that the preionization techniques increase the continuum radiation with the small diameter tubes and are ineffective with the largest diameter tubes used. Author (TAB)

N66-15720# Cutler-Hammer, Inc., Deer Park, N. Y. Airborne Instruments Lab.
STUDY OF SOLID-STATE AND TRAVELING-WAVE MASER TECHNIQUES
J. A. De Gruyl, W. W. Heinz, S. Okwit, and J. G. Smith Griffiss AFB, N. Y., RADC, Nov. 1965 30 p refs
(Contract AF 30(602)-2989)
(RADC-TR-65-366; AD-624359) CFSTI: HC $2.00/MF $0.50

The purpose of this program is to develop improved maser techniques and apply them to a broad-band maser system. The deliverable breadboard maser system has been fabricated, assembled, and initial testing has been completed. The unit basically provided gains of 30 db over 260 Mc of instantaneous bandwidth at 2.1 k. This inherent bandwidth far exceeds that obtained in any other maser known to date. Continued performance testing and limited modifications to the system are being made during the final phase of the program. An extension in time has been requested to enable this work to be completed. The semiconductor device program has been completed. This work has resulted in the development of techniques for limiting as well as modulating microwave signals. The results were presented at the recent PGMTT symposium in Clearwater, Florida. Author (TAB)

N66-15966# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.
NOISE IN AN OPTICAL HOMODYNE SYSTEM
Marvin E. Monroe 1 Oct. 1965 115 p refs
(Contract AF 33(615)-2287)
(Rept.-1935-7; AD-474465)

This report contains the derivations necessary to express the functional dependence of the output of an optical homodyne system including signal and noise terms. The experimental work gives evidence of the validity of these expressions and indicates the order of magnitude of the different effects. Author (TAB)

N66-16086*# Wheeler Labs., Inc., Great Neck, N. Y.
DEVELOPMENT OF MACROSCOPIC WAVEGUIDE AND WAVEGUIDE COMPONENTS FOR OPTICAL SYSTEMS Final Report, 28 Jan.–28 Nov. 1964
E. R. Schineller, H. M. Heinemann, D. W. Wilmot, and H. W. Redlien Washington, NASA, Jan. 1966 144 p refs
(Contract NAS12-2)
(NASA-CR-332) CFSTI: HC $5.00/MF $1.00 CSCL 20E

The design, development, and fabrication of macroscopic waveguide and waveguide components for optical systems which operate in a single spatial mode, are discussed. Feasibility tests were performed on the various waveguide configurations, and results indicate that macroscopic optical waveguides and components are feasible in operation and construction; and that the concept offers promise of high performance components for sophisticated laser systems. L.S.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N66-15215# Illinois Univ., Urbana. Dept. of Mining, Metallurgical and Petroleum Engineering.
THE STUDY OF STABILIZATION EFFECTS IN BINARY AND TERNARY ALLOY SYSTEMS OF THE TRANSITION ELEMENTS Final Report, Oct. 1, 1961–Oct. 1, 1964
Paul A. Beck [1964] 5 p refs
(Grant DA-ARO(D)-31-124-G155)
(AROD-3306-6; AD-623221) CFSTI: HC $1.00/MF $0.50

A study was made of the stabilization effects obtained with Si, Ge and Sn, as well as with Al in binary and ternary alloys with transition elements. TAB

N66-15216# Naval Research Lab., Washington, D. C.
ELECTRON MICROSCOPE FRACTURE EXAMINATION TO CHARACTERIZE AND IDENTIFY MODELS OF FRACTURE
C. D. Beachem 28 Sep. 1965 124 p refs
(NRL-6293; AFML-TR-64-408; AD-623567) CFSTI: HC $4.00/MF $0.75

The fine-scale fracture topographies of both monotonic and fatigue fracture surfaces of several steels and aluminum and titanium alloys have been characterized. Some effects of orientation of specimen upon the fatigue crack surface appearance in 2024 T851 were found. Quasicleavage in hydrogen embrittled, 250000 psi yield strength, maraging steel was discovered. Four overload fracture models, including a previously unreported mode, were found in a 7075 T6 aluminum alloy by precision matching techniques. A number of failure analyses were made. Author (TAB)

N66-15230*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SELECTED MECHANICAL AND PHYSICAL PROPERTIES OF BORON FILAMENTS
Harvey W. Herring Washington, NASA, Jan. 1966 45 p refs
(NASA-TN-D-3202) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Results are presented from an investigation to characterize boron filaments with respect to selected mechanical and physical properties. The investigation of 12 different filaments included examination by metallographic techniques and the determination of mechanical properties from room temperature to 2500° F in argon, air, and vacuum. The study was primarily concerned with the properties of individual boron filaments produced by the deposition of boron on the surface of a fine tungsten substrate wire from a vapor composed of hydrogen and a boron halide compound. These filaments exhibited an average room-temperature strength of 350 ksi and retained approximately two-thirds of this strength at temperatures up to 2000° F. The range of scatter among individual tensile strength values was generally equal to the mean value of strength. An average Young's modulus value of 60×10^3 ksi was recorded. Author

N66-15343*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DEVELOPMENT OF DISPERSION STRENGTHENED TANTALUM BASE ALLOY Quarterly Progress Report No. 6, Feb. 20–May 19, 1966
R. W. Buckman, Jr. and R. C. Goodspeed [1965] 72 p refs (Contract NAS3-2542)
(NASA-CR-54658; WANL-PR-(Q)-007) CFSTI: HC $3.00/MF $0.75 CSCL 11F

Development of dispersion strengthened tantalum base alloys for use in advanced space power systems continued with the melting of the first 4-inch diameter ingot sheet and tubing alloy composition (Ta-8W-1Re-0.7Hf-0.025C). Three additional alloys were produced into 2-inch diameter ingots as part of the composition optimization phase of the program. Six of the planned seven ingots to be produced for this optimization study are in various stages of preparation and evaluation. Phase identification and morphology studies were initiated on a number of alloys using optical and electron microscopy, X-ray, and electron diffraction techniques, and electron beam microprobe analysis. Metallographic procedures for these alloys are detailed. Author

N66-15355*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED AIR BREATHING ENGINE TECHNOLOGY—MATERIALS: A REVIEW OF CONTRACTS
S. J. Grisaffee Washington, NASA, 1966 15 p refs Presented at Refractory Composites Working Group 11th Meeting, Los Angeles, 24–28 Jan. 1966
(NASA-TM-X-52170) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Research programs investigating high temperature materials for hot section components of advanced air breathing jet engines are reviewed. The development of chromium alloys by melting and powder metallurgy techniques, chromium alloy coatings, nickel and cobalt base superalloys, dispersion strengthened superalloys, fiber metallurgy, tantalum coatings, silicide coatings and other miscellaneous coatings on diffusion barriers, and oxidation resistant wire materials are discussed. Studies on the prediction of cooled turbine blade metal temperatures, and steady state creep of dispersion strengthened metals are also discussed. R.N.A.

N66-15373*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
ADVANCED REFRACTORY ALLOY CORROSION LOOP PROGRAM Quarterly Progress Report No. 2, 15 Jul–15 Oct. 1965
R. W. Harrison, ed. [1965] 31 p refs
(Contract NAS3-6474)
(NASA-CR-54845) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Progress is reported on a program to fabricate, operate for 10000 hours, and evaluate a potassium corrosion test loop constructed of T-111 alloy. The T-111 alloy was selected as the containment alloy and Mo–TZC and Nb–132M alloys were selected for inclusion in the turbine simulator. Revisions in the prototype corrosion loop assembly drawings were made based on experience gained in fabrication, installation, and operation of the loop. Specifications for cleaning, welding, and heat treating loop components are being prepared. R.N.A.

N66-15444*# Case Inst. of Tech., Cleveland, Ohio. Dept. of Metallurgy.
MODIFIED EUTECTIC ALLOYS FOR HIGH TEMPERATURE SERVICE Six Month Progress Report
S. F. Ramseyer and J. F. Wallace Dec. 1965 24 p
(Grant NsG-639)
(NASA-CR-69376) CFSTI: HC $1.00/MF $0.50 CSCL 11F

In order to change the normal plate, rod, or needle-like eutectic structures of nickel and cobalt alloys to finer, more dispersed morphology, the alloys were modified by small additions of tungsten and other metals. Modification was beneficial to Co and Ni alloys containing 35, 40, and 45% W; with 50% W, the Ni alloy showed improved structure but the Co alloy did not. In general, the addition of W replaced the lamellar eutectic structure of the alloy with a mixture of primary dendrites, more or less finely divided globular carbides, and small islands of finely divided eutectic. At 1800° C, both time to fracture at 15 000 psi initial stress and ductility were markedly improved. M.W.R.

N66-15459# India. Dept. of Atomic Energy, Bombay. Chemistry Div.

DIFFUSION OF SILVER IN ALUMINUM

M. S. Anand and R. P. Agarwala 1965 18 p refs

(AEET-221) CFSTI: HC $1.00/MF $0.50

Using the residual activity technique, diffusion of silver in aluminum has been studied in the temperature range of 400°–630° C. Diffusion coefficient (cm^2/sec) is expressed by

$$D_{Ag/Al} = 0.210 \pm 0.065 \exp\left(-\frac{29.000 \pm 1.160}{RT}\right).$$

The difference between this value of activation energy and those reported earlier in the diffusion of silver in aluminum-silver alloys has been discussed. Author

N66-15460# United Kingdom Atomic Energy Authority, Risley (England).

ELECTRON METALLOGRAPHY OF IRRADIATED 20Cr–25 Ni–Nb TENSILE SPECIMENS

R. Sumerling 1965 30 p refs Submitted for Publication

(TRG-1056(W))

Strip tensile specimens of 20Cr–25Ni–Nb which had been irradiated to a thermal neutron dose of 3.5×10^{20} nvt at 750° C were tensile tested at 575, 750 and 850° C, at a strain rate of 3×10^{-4} sec^{-1}. These tests showed that irradiation had lowered the rupture ductility at the two upper temperatures. Electron microscopy of the unstrained regions showed that the irradiated specimens contained many more fine precipitates than the unirradiated control specimens, and also 50–150 Å dia. bubbles of irradiation-induced gas at grain boundaries. The amount of gas observed accounted for only about 1% of the calculated content produced by the $^{10}B(n,\alpha)^7Li$ reaction. The gauge-lengths of the two irradiated specimens tested at 750 and 850° C showed micro-cracks and isolated holes up to 0.2 micron dia. at grain boundaries near the fracture. These observations support suggestions that stress-induced growth of grain boundary bubbles occurs. Annealing the unstrained irradiated material at 1200° C for 2 h in vacuo caused the gas bubbles in the interior of the specimens to grow to a diameter up to 0.2 microns. In addition, pores several microns in diameter also developed within 50 microns of the surface in both unirradiated control and irradiated specimens. Author

N66-15485*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ULTRAHIGH-VACUUM CREEP BEHAVIOR OF COLUMBIUM AND TANTALUM ALLOYS AT 2000° AND 2200° F FOR TIMES GREATER THAN 1000 HOURS

Robert H. Titran and Robert W. Hall Washington, NASA, Jan. 1966 27 p refs

(NASA-TN-D-3222) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Creep tests of 100 hours and greater were conducted at 2000° and 2200°F on six commercially available refractory alloys at pressures of 10^{-8} to 10^{-9} torr. The creep behavior of three columbium alloys, FS-85 (Cb+28Ta+10W+1Zr), D-43 (Cb + 10W + 1Zr + 0.1C), and Cb-752 (Cb + 10W + 2.5Zr), and three tantalum alloys, T-222 (Ta+9.6W+2.4Hf+0.01C), T-111 (Ta+8W+2Hf), and Ta-10W (90Ta+10W) was determined at stress-to-density ratios of 2.6×10^4 and 1.3×10^4 inches, respectively, at 2000° and 2200° F. Comparison of creep behavior on the density-compensated basis shows that the tantalum alloy T-222 was the most creep resistant material evaluated. A total creep strain of only 0.1 percent resulted from testing this alloy for 5000 hours at 2000° F at a stress of 15 900 pounds per square inch; while at 2200° F and 8000 pounds per square inch, 0.65-percent strain occurred in 5000 hours. The relative order of creep resistance, on a density-compensated basis, was the same for the materials evaluated at 2000° and 2200°F: T-222, Ta-10W, D-43, FS-85, T-111, and CB-752. Author

N66-15489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MECHANICAL PROPERTIES AND RECRYSTALLIZATION BEHAVIOR OF ELECTRON-BEAM-MELTED TUNGSTEN COMPARED WITH ARC-MELTED TUNGSTEN

William D. Klopp and Walter R. Witzke Washington, NASA, Jan. 1966 36 p refs

(NASA-TN-D-3232) CFSTI: HC $2.00/MF $0.50 CSCL 11F

A study has been conducted of the properties of tungsten fabricated from three ingots consolidated by electron-beam melting. The study included purity as a function of number of melts, recrystallization and grain growth behavior, low-temperature ductility, and high-temperature tensile and creep strength. The level of most metallic impurities in tungsten decreased with increasing number of electron-beam melts, the reduction being greatest for aluminum, iron, nickel, and silicon. The recrystallization rates for worked, electron-beam-melted (EB-melted) tungsten were significantly higher than those observed earlier for arc-melted tungsten. The grain growth rates of EB-melted tungsten were higher than those reported previously for arc-melted tungsten, further reflecting the higher purity of the EB-melted materials. The activation energies for both recrystallization and grain growth in EB-melted tungsten were consistent with expected values assuming grain boundary self-diffusion to be the rate-controlling reaction. The ductile–brittle bend transition temperature for EB-melted tungsten is slightly higher in the worked condition than that reported for arc-melted tungsten. In the recrystallized conditions, the transition temperatures for EB- and arc-melted tungsten are similar. Author

N66-15491*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FRICTION, WEAR, AND ADHESION CHARACTERISTICS OF TITANIUM–ALUMINUM ALLOYS IN VACUUM

Donald H. Buckley and Robert L. Johnson Washington, NASA, Jan. 1966 18 p refs

(NASA-TN-D-3235) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Friction, wear, and adhesion measurements were made in vacuum (10^{-9} mm Hg) of titanium–aluminum alloys containing 11,16 and 21 weight percent aluminum. Experiments were conducted with a 3/16-inch-radius rider sliding on the flat surface of a 2-1/2-inch-diameter disk specimen at loads to 1500 grams. The disk was rotated to produce sliding velocities to 750 centimeters per second. With increasing addition of aluminum to titanium, an increase in lattice ratio

(c/a) for titanium occurred along with a decrease in friction, wear, and adhesion. The increase in (c/a) lattice ratio with the addition of aluminum to titanium occurred even though the unit cell size decreased; these results are unlike those with the addition of tin and oxygen to titanium. While titanium exhibited an adhesion coefficient of 5.3, the titanium–aluminum alloys exhibited adhesion characteristics which could be considered negligible. These alloys exhibited superior friction and wear properties in vacuum compared with 52100 and 440-C stainless than when sliding on themselves. Author

N66-15492*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF ORIENTATION OF GRAINS IN TUNGSTEN ON ITS FRICTION CHARACTERISTICS
Donald H. Buckley Washington, NASA, Jan. 1966 23 p refs
(NASA-TN-D-3238) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The influence of crystallographic orientation on the friction properties of tungsten was determined in both air and vacuum. Friction measurements were made with a 3/8-inch oriented sapphire ball sliding on a large grained tungsten disk, and the orientation of each grain on the tungsten surface was determined. The two sapphire orientations examined were the (0001) plane, [1010] direction, and the (1010) plane, [0001] direction, sliding on the tungsten surface. The sapphire ball was loaded against the disk with a 500-gram load. The disk was then rotated to produce sliding velocities of 0.013 and 0.001 centimeter per second. The vacuum experiments were conducted with electron-cleaned surfaces at 10^{-10} millimeter of mercury. The investigation indicates that tungsten exhibits anisotropic friction properties. Friction characteristics on different crystal planes in a particular direction did not differ markedly; considerable differences in friction coefficient, however, existed in changing crystallographic directions on particular planes. Further, marked differences in friction were observed with changes in crystallographic orientation of the sapphire. Friction decreased considerably when vacuum measurements were repeated in air. Author

N66-15615*# Stanford Univ., Calif. Dept. of Materials Science.
MECHANISMS OF STRENGTHENING AND FRACTURE IN COMPOSITE MATERIALS Third Progress Report, 1 Jun.–30 Nov. 1965
A. S. Tetelman [1965] 16 p refs
(Grant NsG-622)
(NASA-CR-69483) CFSTI: HC $1.00/MF $0.50 CSCL 11D

Progress is reported on the program designed to investigate the mechanisms of strengthening and fracture in composite materials. To study the effect of varying carbide morphology, two steels containing 0.4% and 0.6% carbon were tested in uniaxial tension under plane stress conditions in both the pearlitic and spheriodized forms. The tests were conducted at temperatures from room to −196° C. In the pearlitic steels, composed of lamellar pearlite and proeutectoid ferrite, a ductile-brittle transition was observed at about −150° C for both the 0.4% and 0.6% carbon steels. Small drilled holes can improve the toughness of specimens containing sharp notches. Charpy impact tests and slow-bend tests were performed. Preliminary results indicated that the magnitude of the improvement with holes is a function of the ease of fibrous or shear failure in the material itself. Photomicrographs are presented to show the comparison of the yielded zones of a standard and a drilled specimen of Fe–3% Si specimen midway between the specimen surface and midsection after loading to 50% of their respective general yield loads in pure bending. E.E.B.

N66-15669# ManLabs, Inc., Cambridge, Mass.
THE LATTICE STABILITY OF METALS IV, TRANSITION ELEMENTS OF THE SECOND AND THIRD PERIODS
Larry Kaufman Nov. 1965 35 p p refs To be presented at a colloq. on "Phase Stability in Metals and Alloys", Geneva, Mar. 1966; sponsored by Battelle Mem. Inst.
(Contract Nonr-2600(00))
(TR-11; AD-473554)

The enthalpy and entropy differences between the b.c.c., h.c.p. and f.c.c structures were estimated for transition elements of the second and third periods. Continuous curves depicting these differences as a function of electron number in the zirconium through cadmium and hafnium through gold series are presented. The difference parameters were used to compute thirty binary phase diagrams between elements in the niobium/tantalum through palladium/platinum groups. These binary diagrams, which are restricted to cases where the end members exhibit differing stable crystal structures and miscibility gaps are absent, were calculated on the basis of ideal liquid, b.c.c., h.c.p. and f.c.c. phases. The latter simplification was chosen in order to afford the clearest possible comparison of computed and observed phase diagrams.
Author (TAB)

N66-15696# Springfield Armory, Mass.
A SPECTROSCOPIC, POINT-TO-PLANE METHOD OF ANALYSIS FOR TITANIUM ALLOYS
R. A. Reid 17 Sep. 1965 26 p
(SA-TR-16-1123; AD-624134) CFSTI: HC $2.00/MF $0.50

A spectroscopic, point-to-plane method of analysis has been developed for titanium alloys containing aluminum, chromium, iron, manganese, molybdenum, and vanadium. A direct-reading spectrometer with a high-voltage source provided the high-voltage spark for excitation. Results were obtained from a sequential read-out system and converted to analytical curves. Spectroscopic titanium samples, obtained from the National Bureau of Standards, and graphite pins were used. Representative coefficients of variation and results are presented.
Author (TAB)

N66-15789*# Aerojet-General Corp., Sacramento, Calif.
DIMENSIONAL INSTABILITY OF ALUMINUM ALLOYS FOR EXTREME LOW TEMPERATURE CYCLING APPLICATIONS (GGV MATERIAL INSTABILITY PROBLEM)
F. M. Henson and F. Inouye 31 Jan. 1966 42 p ref
(Contract NAS3-2555)
(NASA-CR-54829; AGC-8800-12) CFSTI: HC $2.00/MF $0.50 CSCL 11F

The problem of critical permanent dimensional changes in grades 6061 and 7075 aluminum alloy valve bodies that occurred during cryogenic thermal cycling is described in this report. A special fabrication process to reduce the distortions within tolerable design levels was developed and applied to test hardware. Test data confirmed that the special process reduced distortions in both aluminum alloys, but the degree of distortion was dependent upon body shape. Author

N66-15814*# Lehigh Univ., Bethlehem, Pa. Inst. of Research.
INVESTIGATION OF THE SOLIDIFICATION, STRUCTURE AND PROPERTIES OF EUTECTIC ALLOYS INCLUDING CONSIDERATION OF PROPERTIES CONTROL First Semi-annual Progress Report
R. W. Kraft and R. W. Hertzberg 22 Dec. 1965 12 p refs
(Grant NGR-39-007-007)
(NASA-CR-69570) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Physical progress in studies of solidification, structure, and properties of eutectic alloys consisted primarily in a literature review, research planning, and development of techniques and procedures. Preliminary results of elevated temperature studies with controlled lamellar Al–$CuAl_2$ eutectic found retention of microstructural anisotropy even when heated for 1200 hrs. within 8° C of the eutectic temperature. G.G.

N66-15875# Naval Ordnance Test Station, China Lake, Calif. Research Dept.

EFFECTS OF ULTRASOUND ON DEFORMATION CHARACTERISTICS OF STRUCTURAL METALS. PART 5: DISCUSSION Technical Progress Report, 1 Jul. 1963–30 Jun. 1964

B. Langenecker, C. W. Fountain, and S. R. Colberg Oct. 1965 18 p refs

(NOTS-TP-3941; TPR-371, Pt. 5; AD-473657)

High-intensity ultrasound at 20 kc/sec is used in studies of mechanisms of metal deformation and treatment. Quantitative details about the experimental conditions are provided in the five parts of this report: (1) modes of intense ultrasonic stress waves in rods and bars, (2) conversion of acoustic energy into heat, (3) applications of ultra-sound at high-strain-rate tensile tests, (4) measurements of internal friction during high-intensity ultrasonic radiation of metals, and (5) discussion of ultrasonic metal deformation along with a comparison between our observations and other reports on the subject of ultrasonic metal forming processes. Author (TAB)

N66-15884# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).

PROGRAMME-FATIGUE TEST ON ALUMINIUM ALLOY LUG SPECIMENS WITH SLOTTED HOLES AND EXPANDED HOLES

J. Schijve and F. A. Jacobs Nov. 1964 38 p refs Sponsored by the Neth. Aircraft Develop. Board

(NLR-TN-M.2139) CFSTI: HC $2.00/MF $0.50

Constant-amplitude tests and programme tests were carried out on 2024-T3 lug specimens with standard holes, slotted holes and expanded holes. The results give information on (1) programme loading versus constant-amplitude loading, (2) cumulative damage and (3) the improvement of the fatigue endurance obtained by the application of slotted and of expanded holes. Author

N66-15905# Reactor Group, United Kingdom Atomic Energy Authority, Culcheth (England). Reactor Materials Lab.

CREEP OF A 20% CR/25% NI/Nb STEEL UNDER REVERSED CREEP CONDITIONS

A. N. Hughes 1965 23 p refs

(TRG-1018(C))

Compressive creep tests have been carried out on an annealed 20 Cr/25 Ni/Nb steel at 750° C and 10000 lb/in^2. In some of the tests the compressive creep strain has been eliminated after 10 hours by the application of a tensile stress; a further 10 hours compressive creep period was then allowed, and the cycle repeated. It has been shown that under these conditions there is a marked degradation of the creep properties of this steel, which results in an increase in creep strain with the number of cycles. Author

N66-15912# United Kingdom Atomic Energy Authority, Harwell (England). Library.

THE VALUE OF THE SELF-DIFFUSION PARAMETERS OF ZIRCONIUM

G. B. Federov Mar. 1965 13 p refs Transl. into ENGLISH from Met. i Metalloved. Chistykh Metal. (Moscow), v. 4, 1963 p 34–40

(AERE-TRANS-1030) HMSO: 1s 9d

The self-diffusion parameters of β-zirconium in stabilized and unstabilized alloys are reported. It is noted that the slope of the temperature vs diffusion coefficient lines increases as a result of stabilizing the structure of the zirconium. Also, the activation energy of self-diffusion increases from 29.8 to 44.8 kcal/gram atom while the pre-exponential factor increases from 1.8×10^{-4} to 4×10^{-2} cm^2/sec. When the self-diffusion parameters of stabilized β-zirconium are used to compute its self-diffusion coefficient at the polymorphic transformation temperature, a value of 3×10^{-11} cm^2/sec is determined. At the polymorphic transformation temperature the self-diffusion coefficient in α-zirconium subjected to preliminary 90-hr annealing at 820° C is 2×10^{-12} cm^2/sec, i.e., an order of magnitude lower. This confirms that in stabilized zirconium a retardation of diffusion is observed in the denser packing. The significance of experimental and theoretical values of the activation energy of self-diffusion are discussed. Also, it was found that alloying zirconium with tin increases the activation energy of self-diffusion, increases the heat of sublimation, reduces the effect of the structural factor on diffusion, and slows down the decrease in Young's modulus with increase in temperature. E.E.B.

N66-15915# United Kingdom Atomic Energy Authority, Culham (England).

THE PREPARATION AND PROPERTIES OF SINTERED Nb_3Sn

C. H. Walker and R. Hancox May 1965 18 p refs

(CLM-R-43) HMSO: 2s 6d

Sintered Nb_3Sn has been formed, which is capable of supporting current densities greater than 10^5 $amps/cm^2$ at 50 kG, and is stable against field changes of at least 55 kG. The factors which affect stability are discussed, including the importance of the structure of the sintered material. Author

N66-15921# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.

STRESS CORROSION OF IRRADIATED STAINLESS STEELS

M. J. Davies, D. A. Landsman, and W. E. Seddon Aug. 1965 21 p refs

(AERE-R-5014) HMSO: 2s 6d

Fully annealed specimens of Type-316 stainless steel and of a 20 Cr–25 Ni–Nb-stabilized stainless steel were subjected to stress corrosion tests in boiling 42% $MgCl_2$ solution: identical specimens were exposed to the same test after receiving doses of fast neutrons up to 2×10^{20} $n\text{-}cm^{-2}$. Irradiation of the Type-316 steel greatly increased its susceptibility to stress corrosion cracking at low stress levels, but the 20–25–Nb steel was immune to cracking in both irradiated and unirradiated conditions. It is proposed that the effect on the Type-316 steel is due to fast neutron radiation damage in the oxide film on the metal. Author

N66-15980*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TENSILE BEHAVIOR OF SAME-LOT SINGLE-CRYSTAL AND POLYCRYSTALLINE TUNGSTEN FROM 2500 TO 5000°F

Jack L. Taylor 15 Nov. 1965 24 p refs

(Contract NAS7-100)

(NASA-CR-89653; JPL-TR-32-827) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The tensile properties of single-crystal tungsten produced by annealing commercial type-MK powder-metallurgy rod at 5150° F were studied at a nominal strain rate of 0.02/min as a function of orientation and temperature (2500 to 5000° F). A preferred orientation was exhibited by the crystals, the tensile axes of over 75% of them being oriented between ≃10 and ≃30° from the [001] corner of the unit triangle. Polycrystalline tungsten of the same lot and chemical composition as the single-crystal material also was tested under the same conditions of strain rate and temperature. The tensile results were consistent with results previously reported by the author for other lots of polycrystalline powder-metallurgy tungsten, including a ductility minimum at ≃3500° F and a maximum at ≃4[illegible]° F. It appears that orientation may be a factor in the ductility minimum in polycrystalline tungsten, presuming that the many small crystals making up the core of the polycrystalline specimens exhibit the same preferred orientation as the single-crystal material. The maximum in elongation which also occurs in both polycrystalline and single-crystal tungsten may be similarly related through preferred orientation. Comparison of polycrystalline and single-crystal tungsten indicated an upper limit of ≃2–1 to the strengthening effect due to grain size at 2500° F and above. Author

N66-16006# Joint Publications Research Service, Washington, D. C.
FORMABLE ALUMINUM ALLOYS FOR HIGH TEMPERATURE SERVICE
L. P. Luzhnikov 20 Jan. 1966 294 p refs Transl. into ENGLISH of the book "Deformiruyemyye Alyumniyevyye Splavy dlya Raboty pri Povyshennykh Temperaturakh" Moscow, Metallurgizdat., 1965 p 2–290
(JPRS-33811; TT-66-30254) CFSTI: $6.00

This monograph is devoted to the study of the nature, structure, and properties of formable aluminum alloys intended for high temperature service. It presents the results of systematic studies of an improtant group of aluminum alloys. Considerable attention is devoted to an explanation of the relationship between the properties of the alloys and their structure and phase and chemical composition. Physical and mechanical properties and heat treatment modes are shown, and the effect of technological factors upon the properties of the alloys are examined. The monograph is intended for the broad circle of engineering and technical workers engaged in the production and application of aluminum alloys, workers of scientific research organizations, and students of senior courses of appropriate specialties. Author

N66-16063# European Atomic Energy Community, Brussels (Belgium).
PLASTICITY OF DISPERSED-PHASE Al/Al_2O_3 [PLASTICITE DES ALLIAGES A PHASE DISPERSEE TYPE Al/Al_2O_3]
P. Guyot 1965 132 p refs In FRENCH; ENGLISH summary
(EUR-2483.f) CFSTI: HC $4.00/MF $1.00

The aim of this work is the plastic deformation mechanisms of SAP, alloy consisting of a dispersion of alumina particles in a polycrystalline aluminum matrix. At first we investigate in detail the SAP structure, and we show the lack of coherence at the aluminum–alumina interface. The processes of plastic deformation can finally be considered with regard to the deformation temperature: (1) at low temperatures (from −196° C to room temperature), the deformation is controlled by the cutting through the forest, of which the density is high and rapidly increases with the strain by the indirect presence of oxide particles; and (2) at high temperatures (from room temperature to 660° C) different processes successively occur: cross-slip of screw dislocations and climb of edge dislocations by diffusion of jogs control the deformation of the aluminium matrix to about 350° C; above 350° C, the high values of activation energy and volume are partially explained by the thermal activation of the gliding of mobile dislocations pinned by the oxide particles, and by thermal activation of the by-passing of attractive trees. It is finally shown that the aluminum grain size has no influence. Author

N66-16105# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEMATISM OF BINARY INTERMETALLIC PHASES
P. I. Kripyakevich and E. E. Cherkashin 9 Apr. 1965 99 p refs Transl. into ENGLISH from Izv. Sektora Fiz.-Khim. Analiza: Inst. Obshch. Neorgan. Khim., Akad. Nauk SSSR (Moscow), v. 24, 1954 p 59–123
(FTD-TT-63-1018/1; TT-65-62159; AD-615027)

Tables of all known binary intermetallic phase systems are alphabetically listed. The tables carry formula, number of atoms in the elementary cell, and spatial group. The dependence of phase composition upon type of crystalline structure (cubical, hexagonal, etc.); packing density of atoms; type of chemical bond; valence; and electron concentration are discussed. L.S.

N66-16148*# National Aeronautics and Space Administration, Washington, D. C.
TITANIUM AND ZIRCONIUM CARBIDE COATINGS ON GRAPHITE [POKRYTIYA IZ KARBIDA TITANA I TSIRKONIYA NA GRAFITE]
A. L. Burykina and T. M. Yevtushok Dec. 1965 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR. Otd. Tekhn. Nauk: Met. i Gornoye Delo (Moscow), no. 5, 1964 p 147–149 refs
(NASA-TT-F-9861) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Description of a method for coating graphite with titanium and zirconium carbides by soaking graphite in liquid metal with subsequent carbidization of the metallic layer. Values for microhardness, lattice period and carbon content in titanium and zirconium carbides, obtained under conditions of annealing, are tabulated. The effect of porosity on the quality of carbide coatings is also considered. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N66-15258 Joint Publications Research Service, Washington, D. C.
IMPROVEMENT IN PROPERTIES OF POLYMER FILMS UNDER INFRARED RADIATION
G. A. Kleyn, L. Kh. Osipova, M. G. Sultanova, and R. I. Alimova *In its* Heliotechnology 21 Dec. 1965 p 36–39 refs (See N66-15251 06-03) CFSTI: $3.00

Experiments were conducted to determine the effects of infrared radiation on the structural, optical, and physicomechanical properties of polymer films used in solar devices. Specimens of polyamide and polyethylene films were irradiated

by infrared lamps for periods ranging from 50 to 250 hours at an average temperature of 80°C. The specimens were then tested for failure, fatigue, and their properties and structure compared to an unirradiated control specimen. In contrast to the effects of other types of radiation, the infrared radiation helped order the macromolecules of the polymer films and effectively improved other properties without changing their external appearance or optical properties. R.N.A.

N66-15332# Rock Island Arsenal Lab., Ill. Research and Engineering Div.
THE CROSSLINKING OF SILOXAZANE ELASTOMERS
Frank B. Testroet Aug. 1965 14 p refs
(RIA-65-1956; AD-623289) CFSTI: HC $1.00/MF $0.50

The objective of this work was to discover means of crosslinking elastomers containing silicon-nitrogen (silazane) bonds in the main chain. The novel character of siloxazane elastomers presented the problem of finding effective curing systems since only limited work in this area had been reported. A screening program was undertaken to evaluate various means of crosslinking the siloxazanes. Crosslinking was achieved by means of thermovulcanization, gamma radiation and several chemicals. However, these vulcanizates were not entirely satisfactory since they were tacky, porous and hydrolytically unstable. Author (TAB)

N66-15358*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SELF-SEALING SHIELDS FOR MICROMETEORITE PROTECTION
Erwin D. Funk 30 Dec. 1965 26 p refs
(NASA-TM-X-53376) CFSTI: HC $2.00/MF $0.50 CSCL 11B

Self-sealing shields for cryogenic propellant tanks are investigated. The self-sealing shields consist of a hexcel covering containing a porous media. The sealing occurs when the cryogenic propellant discharges and solidifies in the porous media which contains a vacuum. Two types of porous media are investigated, fiberglass strands and open cell polyester foam. The shields using polyester foam are shown to be a feasible method of solving the problems caused when a micrometeorite collides with a propellant tank. Author

N66-15387*# Dynatech Corp., Cambridge, Mass.
SOME THERMOPHYSICAL PROPERTY MEASUREMENTS OF POROUS CERAMIC "GLASSROCK"
L. C. Hoagland, R. L. Wentworth, and P. C. Dustin 13 May 1965 29 p ref
(Contract NAS1-4758; Proj. NAS-12)
(NASA-CR-66043; Dynatech-558) CFSTI: HC $2.00/MF $0.50 CSCL 11B

This report describes the measurements performed on a sample of a porous ceramic described as "Glassrock". The thermal conductivity was measured from room temperature to 700°F by means of a comparative test. Over the same temperature range the variation of specific heat with temperature was measured. A determination of the variation of density with temperature was performed using techniques which rely upon measuring the cubical expansion of the material. The following sections of this report present the methods of testing and the procedures followed in this test program. Author

N66-15443*# Stanford Research Inst., Menlo Park, Calif.
A STUDY OF BONDING BETWEEN GLASS AND PLASTIC IN GLASS-REINFORCED PLASTICS, PHASE II Summary Technical Report No. 2, Nov. 1, 1964–Oct. 31, 1965
D. L. Chamberlain, Jr. 15 Nov. 1965 46 p refs *Its* Rept.-8
(Contract NASr-49(14))
(NASA-CR-69385) CFSTI: HC $2.00/MF $0.50 CSCL 11I

Four methods for the evaluation of bonding between plastic materials and an inorganic substrate were studied: peel, contact angle, dilatometric, and sonic. The first three methods were found to yield useful information on clean glass and silica surfaces, and on these surfaces modified by n-butyl groups. For the peel tests a modified apparatus and procedure were developed. Surface modification was applied to macroscopic surfaces such as microscope slides and 2×1.7 inch OD cylinders, as well as to particulate materials. Alkoxylation was evaluated as a method for the preparation of reactive intermediate surfaces. This method has potential for replacing chlorination or fluorination in the preparation of reactive Si–X groups for subsequent alkylation. Alkoxylation has the advantages of lower corrosion of the glass surface, lower temperature than chlorination, and potentially lower cost. Author

N66-15497*# Republic Aviation Corp., Farmingdale, N. Y.
EVALUATION OF HYDRAULIC FLUIDS FOR USE IN ADVANCED SUPERSONIC AIRCRAFT First Semiannual Report
F. Damasco 14 Oct. 1965 111 p refs
(Contract NAS3-7263)
(NASA-CR-54492; FHR-2701-1) CFSTI: HC $4.00/MF $0.75 CSCL 11H

MCS-293 modified polyphenyl ether, PR-143AB fluorocarbon, MLO 60-294 superrefined mineral oil, F-50 silicone, and MCS-3101 halogenated polyaryl are candidate hydraulic fluids being evaluated for use in advanced supersonic aircraft. Pertinent properties have been determined and evaluated for potential use at fluid temperatures up to 600°F at the pump inlet. A four-ball wear tester was converted to a rider-on-disk boundary lubrication tester. Selection of pump bearing materials will be made for each fluid based on tester results. Fluids will be screened in simple pump loops at 400°, 500°, and 600°F with pump discharge pressures of at least 3000 psi. The two fluids which perform best will be endurance tested in a complete hydraulic system for 3000 hours at a selected maximum temperature and pressure. Author

N66-15559# Douglas Aircraft Co., Inc., Santa Monica, Calif. Advance Structures and Mechanical Dept.
STUDY OF RESIDUAL STRESSES IN THICK GLASS-FILAMENT-REINFORCED LAMINATES Final Report, 30 Jun. 1964–15 Oct. 1965
F. E. Stone 15 Oct. 1965 191 p refs
(Contract Nobs-90301)
(SM-49252; AD-623051) CFSTI: HC $5.00/MF $1.00

A study was made to determine the presence, magnitude, causes, effects, and methods of controlling residual stresses in filament-reinforced plastic (FRP) structures for deep submergence application. Residual radial and hoop stresses are described for 18 cylinders of dispersed (4H:2L) construction and 46 all-hoop rings. Four methods of residual-stress analysis are reported and compared. Residual-stress trends are shown as a function of laminate thickness, radius, construction, winding tension, and mandrel temperature. The critical fabrication effects are identified, and the relative effects of most fabrication variables are compared. Residual-stress effects are examined with respect to interlaminar shear, compression, and buckling strength. Results indicate that residual axial and radial stresses are negligible for the thicknesses investigated and that the residual-stress effect on interlaminar shear strength, bending stiffness, and buckling strength is also negligible. Void content

was found to affect laminate stiffness and have a pronounced effect on interlaminar shear strength—particularly on shear fatigue. Author (TAB)

N66-15636# Plastics Research Inst. TNO, Delft (Netherlands).

REPORT ON RESEARCH CONCERNING THE DEVELOPMENT OF A PLASTIC JERRY CAN FOR STORING AND MOVING GASOLINE [VERSLAG VAN DE WERKZAAMHEDEN BETREFFENDE DE ONTWIKKELING VAN EEN KUNSTSTOFJERRICAN VOOR OPSLAG EN TRANSPORT VAN MOTORBENZINE]

O. F. Bartoo and J. C. Molijn 18 May 1965 17 p refs In DUTCH *Its* Internal Rept.-63/65

(TDCK-43542) CFSTI: HC $1.00/MF $0.50

In the development of plastics for fuel tank structures, research was undertaken to determine the physical, chemical, and thermal properties of several candidate materials. In order to more accurately define the requirements, the molding and processing technologies involved were also considered. A test program, based on selected parameters, was conducted, and findings on the chemical composition and suitability of the materials are tabulated. Transl. by J.O.

N66-15645 Committee for Fishery Research TNO, Utrecht (Netherlands). Lab. for the Investigation of Materials used in the Fisheries.

NYLON CORDS FOR THE BAK-9 TYPE ARRESTING GEAR [NYLON TAPES VAN DE BAK-9 BARRIER]

Sep. 1965 11 p In DUTCH

(TDCK-43539) CFSTI: HC $1.00/MF $0.50

Performance tests on the nylon cords showed that the cord can withstand repeated loads (60 X 14 tons), but that poor attachment methods cause ripping. It is pointed out that the arresting gear link with which the cord is chained to the steel cable needs improvement, and the necessity for checking the cord after each use is emphasized. The recommendation is made that the cord should be smoothly wrapped around the attachment points, and that the diameter of the winding curves should be enlarged. Transl. by J.O.

N66-15706# Army Weapons Command, Rock Island, Ill. Research and Engineering Div.

IMPROVEMENT IN COMPRESSION SET RESISTANCE OF ELASTOMERIC VULCANIZATES USING CADMIUM OXIDE

Edward W. Bergstrom Nov. 1965 22 p refs

(RIA-65-3024; AD-624744) CFSTI: HC $1.00/MF $0.50

Cadmium oxide (CdO) was evaluated in numerous elastomeric vulcanizates as an additive for improving compression set resistance. It was found to be effective in certain SBR, NBR and carboxylic rubber vulcanizates, significantly lowering compression set and allowing shorter cure times to be used. The compression set of a sulfur-altax cured NBR vulcanizate, for example, was reduced by as much as 50% (% change from value found for same compound without CdO) and cure times as short as 5 or 10 minutes at 292°, 307°, and 320° F could be used. Sulfur-accelerator cured SBR and NBR vulcanizates containing CdO were found to be somewhat less scorch resistant than the same vulcanizates without CdO but were not as scorchy as certain nonelemental sulfur cured vulcanizates. Author (TAB)

N66-15770*# Peninsular ChemResearch, Inc., Gainesville, Fla.

DEVELOPMENT OF VULCANIZABLE ELASTOMERS SUITABLE FOR USE IN CONTACT WITH LIQUID OXYGEN Second Annual Summary Report, 9 May 1964–8 May 1965

Paul D. Schuman 8 Jun. 1965 146 p refs

(Contract NAS8-5352)

(NASA-CR-69544; CPB-02-1163-63) CFSTI: HC $4.00/MF $1.00 CSCL 11J

Selected references have been compiled concerning polymer structure as related to thermal properties with major emphasis placed on fluorine containing polymers. Glass transition temperature as related to polymer structure is discussed. Several new monomers have been prepared: $CF_3OCH = CF_2$, $CF_3OCF = CHF$, $(CF_3O)_2C = CF_2$ and $SF_5OCF = CF_2$. Elastomeric copolymers have been prepared from $CH_2 = CF_2$ and the first three monomers. Transition temperatures of a number of polymers have been determined by DTA and the extension of our present knowledge concerning structure–thermal properties relationshp is discussed. The previously unreported $CHFBrCHFBr$ was synthesized. Optimum conditions for the preparation of CF_3OF, COF_2 and $(CF_3O)_2$ have been determined. $(CF_3O)_2$ has been added to $CFCl = CFCl$ to give mainly telomers. An attempt to prepare $(CH_3O)_2C = CF_2$ and $(CF_3CH_2O)_2C = CF_2$ by the Wittig synthesis was not successful. Reaction of $(CF_3)_2C = O$ with C_2F_4 in the presence of CsF gave a low conversion to a complex liquid mixture. A low molecular weight siloxane polymer $\{C(CF_3)_2OSi(CH_3)_2O\}_x$ and a poly(carbonate), $\{OCH_2(CF_2)_3CH_2OCO\}_x$ were prepared. Attempts to prepare C_2F_5OF by reaction of AgF_2 with CF_3COF and by indirect reaction through the intermediate $CF_3OOC_2F_5$ were not successful. An attempt to prepare $CsOCF_3$ resulted in only limited success. Author

N66-15791*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMAL RADIATION ABSORPTANCE AND VACUUM OUTGASSING CHARACTERISTICS OF SEVERAL METALLIC AND COATED SURFACES

Takuo Mimura, Everlyn Anagnostou, and Paul E. Colarusso Washington, NASA, Feb. 1966 58 p refs

(NASA-TN-D-3234) CFSTI: HC $3.00/MF $0.50 CSCL 11C

Space simulating vacuum chambers frequently require walls of high thermal radiation absorptance. A number of surface coatings have essentially thermal blackbody absorptance characteristics; however, their utility may be limited by the requirement for maintaining high vacuum levels in the chamber. This report presents data on the thermal radiation absorptance and the vacuum outgassing characteristics of several commercial surface coatings that can be easily applied to chamber walls. Sixteen stainless-steel specimens coated with organic paints, lacquer, and nylon were tested for normal spectral absorptance using a heated-cavity reflectometer (hohlraum) in conjunction with a double beam spectrophotometer over the wavelength range from 2 to 15 microns. Total normal absorptances for 1115° and 1500° F source temperatures were calculated from the experimental spectral data. Four of the higher absorptance coatings are missile black, black lacquer, Rust-Oleum silver gray, and Rust-Oleum white. The outgassing tests were conducted by using a laboratory vacuum system apparatus with glass bell jar. The rate of outgassing was determined to permit a comparative evaluation between 29 metallic and painted metallic cylinders. Unpainted stainless-steel, aluminum, and copper specimens demonstrated the lowest outgassing rate, whereas nylon coated specimens showed the highest rate. Painted specimens showed more than 10 times as high an outgassing rate as that of the unpainted metal surfaces. The outgassing rate decreased when painted surfaces were previously baked or outgassed. Author

N66-15891# United States Rubber Co., Wayne, N. J. Research Center.
RESEARCH AND DEVELOPMENT OF HIGH TENACITY FIBERS. POLYOLEFINS Quarterly Progress Report No. 6, 1 Nov. 1963–31 Jan. 1964
H. P. Kato and J. S. Lasky 7 Feb. 1964 16 p ref
(Contract Nonr-3767(00)(X))
(AD-623893) CFSTI: HC $1.00/MF $0.50

The conversion of our spinning four filaments to eight filaments was achieved without complications and a top spinning speed of 500 ft/min has been reached. An improvement in the intrinsic viscosity of the spun filaments has been realized through the practice of blanketing the molten filaments within the thermal jacket with nitrogen. The breaking elongations are noticeably improved, perhaps by a factor of one-third. The tenacities have been maintained and are reasonably high. The development of profax 6823 fiber strength increases with an increasing amount of orientation fixed during spinning, a justifiable reversal of an earlier observation. This finding lessens in part the need for achieving spinning speeds beyond our already realized current levels. A surface roughness effect was observed this quarter which appears to be limiting further improvements both in spinning speed and in the attainment of higher strength. The problem remains to be explored. Author (TAB)

N66-16066*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OUTGASSING RATES IN POLYMERIC FOAMS
E. F. Cuddihy and J. Moacanin 15 Dec. 1965 20 p refs
(Contract NAS7-100)
(NASA-CR-69727; JPL-TR-32-840) CFSTI: HC $1.00/MF $0.50 CSCL 11I

Diffusion rates for carbon dioxide were determined on closed-cell polyurethane foams of varying densities by monitoring, for two to three weeks, the loss of weight from specimens suspended in a vacuum of 10^{-7} mm Hg. The experimental data were used to calculate diffusion coefficients for these materials, which were found to be of the order of 10^{-6} to 10^{-5} cm^2/sec between 22 and 81° C. The solution of the diffusion equation for an idealized model for a foam yielded the following expression for the diffusion coefficient:

$$D=P_e\left(\frac{RT}{M}\right)\left(\frac{\rho_0}{\rho}\right)\left[\frac{1}{(1-\rho/\rho_0)^{1/3}}+1+(1-\rho/\rho_0)^{1/3}\right]$$

which relates the diffusion coefficient D to the foam density ρ and to the permeation constant P_e and the density ρ_0 of the bulk polymer; R is the gas constant, T the temperature, and M the molecular weight of the gas. Using this equation and experimentally obtained values of D, a P_e of 5.1 × 10^{-9} (cc STP) mm/sec/cm^2/cm Hg was calculated for the polyurethane material comprising the foam, which agrees within a factor of 2 for reported P_e constants for polyurethane. Author

N66-16152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
KINETICS OF GRAPHITIZATION. I: THE HIGH-TEMPERATURE STRUCTURAL TRANSFORMATION IN PYROLYTIC CARBONS
D. B. Fischbach 1 Feb. 1966 40 p refs
(Contract NAS7-100)
(NASA-CR-69917; JPL-TR-32-532) CFSTI: HC $2.00/MF $0.50 CSCL 11B

Under heat treatment at high temperatures, pyrolytic carbons undergo an extensive structural transformation. Layer stacking order, crystallite size, and preferred orientation increase. The kinetics of this transformation has been investigated for several pyrolytic carbons in the temperature range 2400–3000° C. The transformation was found to be thermally activated, with an effective activation energy of about 260 kcal/mole. The fundamental graphitization process appeared to be the same for all of the carbons studied, but there were differences in their detailed kinetic behavior associated with differences in as-deposited microstructure. Variations in both the rate and the mode of transformation can be understood in terms of the dependence of the graphitization process on apparent crystallite layer diameter. A simple model of the graphitization process consistent with these observations is discussed. The significance of these observations for engineering applications is considered briefly. Author

N66-16165# Boeing Co., Morton, Pa. Airplane Group.
FEASIBILITY STUDY OF ON-SITE FABRICATED BEACH MATTING, MAY–SEPTEMBER 1965
J. G. Mc Ewan Nov. 1965 78 p refs
(Contract NOM-73258)
(D6-57117; AD-623952) CFSTI: HC $3.00/MF $0.75

The on-site fabrication of beach matting using plastic resins and other lightweight materials was investigated. It was assumed that rapid curing materials could be sprayed or poured over sand, resulting in a surfacing of sufficient strength to allow the passage of heavy vehicles. Materials were sought which had desirable characteristics such as rapid curing under wide temperature and moisture conditions, low cost, low toxicity, strength-to-weight ratio, easy application, and extended storage life. Forty three materials were evaluated. Materials which did not cure within a prescribed 3-hour limit were eliminated from further structural testing. Twenty materials were subjected to small-scale structural testing. Of these materials, three polyester resins, one epoxy resin, and one polyurethane foam exhibited the highest strength characteristics. Static wheel-load tests of 10,000 pounds and 70 psi tire pressure, simulating the heaviest marine wheeled vehicle to travel on matting, were performed on 3 by 5 foot specimens and the following results were obtained: (a) All polyester specimens reinforced with 17 to 35 percent chopped fiberglass withstood the 10,000 pound wheel load. (b) Epoxy specimens reinforced with 19 to 32 percent chopped fiberglass withstood the 10,000 pound wheel load. (c) One polyurethane foam specimen with an 18 pound per cubic foot density and an average thickness of 1 inch failed at a 3700 pound wheel loading. TAB

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N66-15208# Air Force Cambridge Research Labs., Bedford, Mass.
AN ALGORITHM FOR THE DEFORMATION METHOD OF QUADRATIC PROGRAMMING
Roger Even Bove Sep. 1965 113 p refs *Its* Phys. and Mathematical Sci. Res. Papers No. 142
(AFCRL-65-703; AD-624141) CFSTI: HC $4.00/MF $0.75

The algorithm presented represents the Zahl deformation method for quadratic programming. It gives an explanation of a modified Iverson programming language. TAB

N66-15210# Wisconsin Univ., Madison. Mathematics Research Center.
APPROXIMATE SOLUTION OF THE EXTERIOR DIRICHLET PROBLEM AND THE CALCULATION OF ELECTROSTATIC CAPACITY
Donald Greenspan and Edward Silverman Aug. 1965 17 p refs (Contract DA-11-022-ORD-2059)
(MRC-538; AD-623739) CFSTI: HC $1.00/MF $0.50

A digital computer technique is described for approximating the solution of the exterior Dirichlet problem. The essence of the method is the combination of geometric inversion with a method for approximating the solution of an interior Dirichlet problem. Two and three dimensional problems are discussed separately because each requires a different treatment of boundary data. The technique for three dimensions extends to higher dimensional problems. Application is made to the calculation of electrostatic capacity by reducing the usual formula for capacity to one which requires only the evaluation at the origin of the solution of a particulary simple interior Dirichlet problem. Finally, the capacity of a unit cube is estimated to be 0.661. Author (TAB)

N66-15213# Wisconsin Univ., Madison. Mathematics Research Center.
ITERATIVE SOLUTION OF NONLINEAR OPTIMAL CONTROL PROBLEMS
J. B. Rosen Jul. 1965 45 p refs
(Grant NGR-50-022-028; Contract DA-11-022-ORD-2059)
(MRC-591; AD-623747) CFSTI: HC $2.00/MF $0.50

The solution of nonlinear, state-constrained, discrete optimal control problems by mathematical programming methods is described. The iterative solution consists essentially of Newton's method with a convex (or linear) programming problem solved at each iteration. Global convergence of the iterative method is demonstrated provided a convexity and constraint set condition are both satisfied. The computational solution of nonlinear equation control problems makes use of a previously developed method for state-constrained linear equation problems. The solution method for nonlinear problems is illustrated by means of two numerical examples. Author (TAB)

N66-15235# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASYMPTOTICS OF CERTAIN FUNCTIONALS IN BOUNDARY PROBLEMS OF A TWO-DIMENSIONAL RANDOM STRAYING
V. S. Korolyuk 24 Sep. 1965 14 p refs Transl. into ENGLISH from the publ. "Predel'nyye Teoremy Teorii Veroyatnostev" Tashkent, Akad. Nauk, USSR, Inst. Mat., 1963 p 43-48
(FTD-TT-65-675/1+4; AD-622377) CFSTI: HC $1.00/MF $0.50

In this report algorithms are formulated of asymptotic decompositions in boundary problems of two-dimensional random straying, obtained by the method of analyzing equations for the sought for distributions, containing a small parameter. TAB

N66-15279# Wisconsin Univ., Madison. Army Mathematics Research Center.
INFINITE SERIES OF KAMPE DE FERIET'S DOUBLE HYPERGEOMETRIC FUNCTION OF HIGHER ORDER Technical Summary Report
F. M. Ragab Sep. 1965 18 p refs
(Contract DA-11-022-ORD-2059)
(MRC-587; AD-623764) CFSTI: HC $1.00/MF $0.50

Infinite series for Kampe de Feriet's hypergeometric functions of two variables are established. Particular cases involving expansions of Appel's functions are deduced. TAB

N66-15323*# Wisconsin Univ., Madison Theoretical Chemistry Inst.
METHODS OF QUADRATURE FOR EULER TRANSFORM INTEGRALS
Peter M. Livingston 22 Feb. 1965 29 p refs Submitted for Publication
(Grant NsG-275-62)
(NASA-CR-57042; WIS-TCI-76) CFSTI: HC $2.00/MF $0.50 CSCL 12A

Several methods of treating Euler transform integrals exist. One such method follows from the expression of the Euler transform kernel as a bilinear series of independent solutions to the Jacoby equation valid for the integration variable in the real interval -1 to 1 and the transform variable outside. The transform function then is expressed as a series of solutions of the second kind to the Jacoby equation whose coefficients are the expansion coefficients of the function to be transformed in the complete set of Jacoby polynomials, provided the latter exist. Such a series is absolutely convergent for the transform variable not on the real interval cited above. Another method, due to MacRobert, permits quadrature of the Euler transform integral directly for certain integrands. Finally, the expansion of the Euler kernel in a bilinear series of Bessel functions and Neumann polynomials valid for the integration variable on the finite interval, 0 to a, is mentioned, and applied to several integrals. Examples of all three methods are given. Author

N66-15330# Naval School of Aviation Medicine, Pensacola, Fla.
THE K-COEFFICIENT, A PEARSON-TYPE SUBSTITUTE FOR THE CONTINGENCY COEFFICIENT
Robert J. Wherry, Jr. and Norman E. Lane 25 May 1965 20 p refs *Its* Rept.-43
(NSAM-929; AD-622776) CFSTI: HC $1.00/MF $0.50

The Pearson product-moment correlation coefficient is recognized as the basic equation for relationship. Well-known and widely used derivatives of the Pearson equation include the point-biserial correlation, the Spearman rank-difference correlation, the fourfold point correlation, and the correlation ratio. Expression of relationships between categorical variables has previously been possible only by means of the contingency coefficient. This paper describes an extension of Pearson's basic equation to provide a measure of relationship between two categorical variables, the 'K' coefficient, which avoids many of the disadvantages inherent in the contingency coefficient. Author (TAB)

N66-15378*# New York State Univ., Syracuse.
PRODUCT FORM OF INVERSES OF SPARSE MATRICES Progress Report
Reginald P. Tewarson Nov. 1965 8 p
(Grant NGR-33-015-013)
(NASA-CR-69270) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Ten methods are discussed for the product form in inverses of sparse matrices. A brief description of the density measures associated with each of six methods is given. The question of *a priori* estimation of the density of product form of inverse of a matrix of given density was also investigated. On the basis of probabilistic estimates a recursive formula was derived for the methods currently in use in actual linear programming codes. This formula gives a fairly good estimate for the density growth of the eta vectors. It also agrees well with the results obtained for the practical production problems in linear programming codes. E.E.B.

N66-15415# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).
ON ERROR PROPAGATION IN THE RESOLUTION CORRECTION
Georg Quittner 1965 26 p refs Submitted for Publication (SGAE-PH-25/1965) CFSTI: HC $2.00/MF $0.50

If experimental functions subject to random fluctuations are replaced by appropriate smoothed versions, the appearance of spurious oscillations in the results of resolution correction can be avoided. The truncation of series expansions of the experimental functions with respect to a suitable system of orthogonal functions is a smoothing operation of this kind. Three of such smoothing operations are introduced and some comments on their use are given. An analysis by means of Fourier transforms, of a simplified resolution equation is used to give insight into the respective roles of the frequency spectrum of the true function, of the uncertainties of the input function and of the resolution function, and of resolution width, in determining the amount of true details in the results of measurement. Implications for the proper number of equations to be used in the solution of the resolution equation and for the choice of the resolution width in an experimental arrangement are considered. Author

N66-15437*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HADAMARD MATRICES OF ORDER 20
Marshall Hall, Jr. 1 Nov. 1965 49 p refs
(Contract NAS7-100)
(NASA-CR-67843; JPL-TR-32-761) CFSTI: HC $2.00/MF $0.50 CSCL 12A

This report studies Hadamard matrices of order 20. Proof is given that there are exactly three classes of such matrices; the work done to show this result is discussed, and the classes are found explicitly. *Class* refers to permutation of rows and columns, and changing the sign of entire rows and columns. Author

N66-15500*# State Univ. of Iowa, Iowa City.
DERIVATION OF MAPPING FUNCTIONS FOR STAR-SHAPED REGIONS; AND SUPPLEMENT
Kwan Rim and Roger O. Stafford Washington, NASA, Mar. 1965 68 p refs
(Grant NsG-576)
(NASA-CR-192) CFSTI: HC $3.00/MF $0.75 CSCL 12A

This report presents a simple method of deriving approximate mapping functions in the form of low order polynomials, which conformally map an annular region onto one whose inner and outer boundaries are star shaped and circular. The derivation is based on the Schwarz-Christoffel transformation. Illustrations are carried out in detail for a number of typical star-shaped regions. Some of the final results are presented by graphs, from which one may readily derive a particular polynomial for the approximate mapping of a certain class of star-shaped regions. Author

N66-15531# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CONSTRUCTION OF FORMAL SOLUTIONS FOR ONE CLASS OF NONLINEAR MIXED BOUNDARY VALUE PROBLEMS AND APPLICATION OF KRYLOV-BOGOLIUBOV ASYMPTOTIC METHODS IN THE INVESTIGATION OF SINGLE-FREQUENCY OSCILLIATIONS
B. I. Moseenkov [1965] 24 p refs Transl. into ENGLISH from Matem. Fiz. (Kiev), 1965 p 97–118

Solutions for a class of nonlinear mixed boundary value problems described by a quasi-wave equation with nonlinear boundary conditions are constructed. The Krylov-Bogoliubov asymptotic methods are applied in the investigation of single-frequency oscillations. M.R.W.

N66-15567# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ERROR ESTIMATES OF THE BUBNOV-GALERKIN METHOD IN THE EIGENVALUE PROBLEM
G. Vainikko [1965] 27 p refs Transl. into ENGLISH from Vychisl. Mat. i Mat.-Fiz. (USSR), v. 5, no. 4, 1965 p 587–607

Some very general asymptotically exact error estimates of the Bubnov-Galerkin method are established for the eigenvalue problem. The main difficulty in deducing such error estimates falls into the case of equations of the second kind. Carryover of the results to equations of a more general type is conducted in the customary manner. All the quantities entering into the general error estimates may be estimated to the end only after the selection of the coordinate sequence has been concretized. A special selection of the coordinate sequence is considered. The efficiency of the error estimates obtained is illustrated by application to boundary value problems. R.N.A.

N66-15608# Naval Ordnance Lab., White Oak, Md.
REPRESENTATIONS INVOLVING CONTINUED FRACTIONS FOR THE RECIPROCALS OF SOME HYPERGEOMETRIC FUNCTIONS
Joseph H. Eberly Oct. 1965 13 p refs
(NOLTR-65-151; AD-622975) CFSTI: HC $1.00/MF $0.50

A new class of representations of some of the more common higher transcendental functions is developed. These representations involve continued fractions in a compact way, and consequently may find use in highspeed digital computer routines designed to compute these functions numerically. Several examples are given for Bessel functions and the general confluent, hypergeometric function. Author (TAB)

N66-15667# Lockheed Missiles and Space Co., Sunnyvale, Calif.
METHODS FOR THE APPROXIMATE SOLUTION OF SINGULAR INTEGRAL EQUATIONS
V. V. Ivanov [1965] 53 p refs Transl. into ENGLISH from "Matematicheskii Analiz 1963" Moscow, 1965 p 125–177

A survey is presented of research and methods in the numerical solution of one-dimensional linear singular integral equations. Four different groups of approximation methods considered are solutions for Fredholm integral equations, linear functional equations in Hilbert and Banach spaces, singular linear equations, and generalizations of known methods as well as those of nonlinear programming. Solutions are specifically related to analysis and synthesis of automatic control systems. Properties and the approximate calculation of singular integrals are reviewed, and approximate solutions are considered for both open and closed contours of integration. Approximate solutions are evolved for a system of singular integral equations, and for convolution-type singular integral equations. M.W.R.

N66-15697# System Development Corp., Santa Monica, Calif.
PROOF OF THE FIXED POINT THEOREMS OF POINCARE AND BIRKHOFF
R. B. Barrar 21 Oct. 1965 23 p refs
(SP-2235/000/00; AD-623737) CFSTI: HC $1.00/MF $0.50

A topological proof is presented of the fixed point theorems of Birkhoff and Poincare. The proof is modeled after the simplest proofs of the Brouwer Plane Translation Theorem and even improves on these in several respects. Author (TAB)

N66-15709# Stanford Research Inst., Menlo Park, Calif.
SUBDIRECTLY IRREDUCIBLE UNARY ALGEBRAS Scientific Report No. 4
Michael Yoeli 15 Sep. 1965 16 p refs
(Contract AF 19(628)-5092)
(AFCRL-65-759; AD-624578) CFSTI: HC $1.00/MF $0.50

Subdirect representations of finite unary algebras are studied. Elementary considerations of the corresponding directed graphs yield necessary and sufficient conditions for connected finite unary algebras to be irreducible, i.e., to have only trivial subdirect representations. Author (TAB)

N66-15710# Stanford Research Inst., Menlo Park, Calif.
SUBDIRECT DECOMPOSITIONS OF TRANSITION GRAPHS Scientific Report No. 3
Michael Yoeli and Clarence M. Ablow 1 Sep. 1965 31 p refs
(Contract AF 19(628)-5092)
(AFCRL-65-758; AD-624577) CFSTI: HC $2.00/MF $0.50

In a preceding report canonical expressions for transition graphs and their direct products were derived. In this report, these expressions are applied to obtain an algorithm for the representation of a complete, connected transition graph or flower as a subgraph of the direct product of smaller flowers. The decomposition algorithm is related to a quadratic all-integer programming problem, which is discussed in detail.
Author (TAB)

N66-15779# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON OPERATIONS RESEARCH
24 Sep. 1965 34 p refs In DUTCH, ENGLISH, FRENCH, and GERMAN *Its* Vol. 9, No. OR-74 CFSTI: HC $2.00/MF $0.50

Presented is a compilation of report literature on developments in operations research, linear programming, game theory, information theory, management, economics of system analysis, war gaming as a technique in the study of operational research problems, cost-effectiveness for military systems analysis, mathematical statistics, and reliability of electronic parts. A program, initiated by the NATO Science Committee, of graduate apprenticeships in operational research is described.
M.R.W.

N66-15890# California Univ., Los Angeles. Western Management Science Inst.
GEOMETRIC DISTRIBUTION IN SOME TWO DIMENSIONAL QUEUING SYSTEMS
Richard V. Evans Jan. 1965 33 p refs *Its* Working Paper No. 64 Sponsored in part by Ford Found.
(MSRP-RR-93; AD-612357) CFSTI: HC $2.00/MF $0.50

The state of the system is a two dimensional random variable. All transition events have negative exponential time distributions with positive means. For any pair of states (n, i) and (n, j) there is at least one possible sequence of transitions from one to the other such that in all states visited N_1 equals n. TAB

N66-15950# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
A DYNAMIC PROGRAMMING FORMULATION FOR DISPOSABLE AND REPARABLE INVENTORY
Ernest Gerald Hurst, Jr. Jun. 1965 269 p refs *Its* Tech. Rept.-12
(Contracts DA-31-124-ORD-14; DA-31-124-ARO-D-209)
(AROD-968-40; AD-466769)

A proof the optimality of the simple two bin (s, S) policy for controlling inventory has been obtained by H. Scarf for surprisingly weak conditions. In quite another direction, E. S. Phelps has obtained the optimal policy structure when inventories of reparable and ready-to-issue units of the same tem are controlled with the action options of procurement, repair and disposal available. The current paper reports an attempt to marry these two results. A simple model of inventory in which only procurement is possible and at a proportional cost is thoroughly reviewed to introduce the notation and motivate the later extensions. The addition of a procurement set-up cost leads to Scarf's result, which is also reviewed with a rather more complete discussion of its justification than heretofore published. The option of disposal is introduced and an optimal structure similar to that in the previous case is obtained for proportional action costs. It is demonstrated that the analogous multiple stage extension of Scarf's result with action set-up cost is not possible, although the single period structure is obtained. The theoretical results are compared to the actual operating procedures which first motivated the study and suggestions are made for further applied as well as theoretical research.
TAB

N66-16032*# Florida State Univ., Tallahassee. Dept. of Statistics.
SEQUENTIAL RANK TESTS. II. A MODIFIED TWO-SAMPLE PROCEDURE
Ralph A. Bradley, Sarla D. Merchant, and Frank Wilcoxon Jun. 1965 21 p refs
(Contract Nonr-988(08))
(ONR-TR-16; AD-623829) CFSTI: HC $1.00/MF $0.50

This paper describes modifications of the sequential, two-sample, within-group, rank tests developed earlier. A modified, configural rank test is discussed in some detail and is a procedure based on rerankings of observations as new groups of observations are obtained sequentially. A numerical application is given. Monte Carlo results are presented on the modified, configural rank test and compared with earlier studies. Proofs of termination of the test are reported and outstanding unsolved problems noted. Author (TAB)

N66-16061# Kansas Univ., Lawrence. Dept. of Mathematics.
THEORY OF BESSEL POTENTIALS, PART II
R. Adams, N. Aronszajn, and K. T. Smith Jul. 1964 161 p refs Revised
(Contract Nonr-583(13))
(TR-8; AD-605333) CFSTI: HC $5.00/MF $1.00

Open subsets of a euclidean space are considered in the theory of Bessel potentials. It is stated that the most natural way of defining potentials in a subdomain D of R^n is to define them as restrictions of potentials in the whole space. This class is denoted by $P^\alpha(D)$. However, this is not an intrinsic definition and it would be inconvenient in applications. Therefore, the class $\check{P}^\alpha(D)$ formed by functions in $P^\alpha_{loc}(D)$ and having a finite standard norm $|u|_{\alpha,D}$ is introduced. Relative to this an investigation is made of the class $\check{P}^\alpha(D)$ and its relations to $P^\alpha(D)$. Also, an investigation is made of those domains where $\check{P}^\alpha(D) = P^\alpha(D)$, and to find as many general classes of domains as possible for which the equality still holds. The equality can be characterized by the fact that for the class $\check{P}^\alpha(D)$ there exists a linear continuous extension-mapping into the class $P^\alpha(R^n)$ assigning to each $u \in \check{P}^\alpha(D)$ an extension $\tilde{u}$, with

$\tilde{u} \epsilon P^{\alpha}(R^n)$ defined in the whole space. In addition to these investigations many other properties of functions in $\tilde{P}^{\alpha}(D)$ are examined. C.T.C.

N66-16085*# North Carolina Univ., Chapel Hill. Computation Center.
[COMPUTER-ORIENTED AND DIFFERENTIAL EQUATIONS STUDIES] Progress Report, 1 Oct. 1964–21 Apr. 1965
James W. Hanson 16 Jul. 1965 41 p ref
(Contract NAS8-1528)
(NASA-CR-69715) CFSTI: HC $2.00/MF $0.50 CSCL 12A

Computational studies are reported for the following areas: (1) control problems that determine the angle of rocket thrust with emphasis on the "thrust baffle" which permits the amount of thrust to be varied continuously between its off position and its maximum value; (2) conversion of differential systems with non-linear controls to linear algebra and its application to solutions of the two-point boundary condition of the flat earth problem; (3) a stepwise procedure of determining best prediction equations for computing the value of a dependent variable; (4) computations on a series of general algorithms that would simplify any given algebraic expression through the collection or cancellation of like terms by factoring out common terms and the development of a computer program for the implementation of these algorithms; and (5) development and implementation of an algorithm for performing analytic differentiations by computer and algorithms to do algebraic simplifications of equations through the collection and cancellation of common terms. G.G.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N66-15246*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INTERPRETATION OF TIROS RADIATION DATA FOR PRACTICAL USE IN SYNOPTIC WEATHER ANALYSIS
Lewis J. Allison and Guenter Warnecke [1964] 53 p refs Submitted for Publication
(NASA-TM-X-54966) CFSTI: HC $3.00/MF $0.50 CSCL 04B

Radiation data in the 8–12 micron atmospheric window and 6–6.5 micron water vapor absorption region acquired from the TIROS III meteorological satellite are used to demonstrate some of the practical applications of satellite radiation data in synoptic weather analysis. These applications include the mapping of horizontal cloud patterns at three different scales, the derivation of mean relaitve humidities in the troposphere, and the inference of vertical cloud structure. Each of the applications is discussed in the light of the corresponding conventional surface, upper air, vertical motion, relative humidity, precipitation, and cloud cover charts. Satellite television pictures are used in the discussion of meso- and macro-scale cloud mapping. In general, a good synoptic correspondence is found between the conventional data and television pictures and the radiation data. Author

N66-15284 Library of Congress, Washington, D. C. Aerospace Information Div.
RESULTS OF METEOROLOGICAL OBSERVATIONS ON THE HIGH TOWER [NEKOTORYE RESULTATY METEOROLOGICHESKIKH NABLYUDENIY NA VYSOTNOY BASHNE]
G. B. Mashkova *In its* The Soviet 300-Meter Meteorol. Tower 25 Mar. 1964 p 47–94 refs (See N66-15282 06-13) CFSTI: HC $6.00/MF $1.25

The results of data on air temperature, wind velocity, and wind direction, taken from tapes of automatic recording instruments placed at 14 levels of a 300-meter meteorological tower, are tabulated and discussed. Isopleths of air temperature are also given. L.S.

N66-15317*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
INVESTIGATION OF WARM FOG PROPERTIES AND FOG MODIFICATION CONCEPTS
Roland J. Pilie Washington, NASA, Jan. 1966 76 p refs
(Contract NASr-156; Proj. Fog Drops)
(NASA-CR-368) CFSTI: HC $3.00/MF $0.75 CSCL 04B

Mathematical models have been formulated to describe the dynamic properties of warm fog. In the laboratory, experiments were conducted to determine the effects of ionic surfactants on droplet coalescence and to study the behavior of nuclei treated with fatty-alcohol monolayers. Daily measurements were made of the nuclei active at slight supersaturations characteristic of natural fog. The results of these measurements together with past analytical and experimental findings were used to generate new ideas for fog suppression and to evaluate survey of fog frequency in the Continental United States describes those regions having frequent occurrences of dense fog, i.e. fog that limits visual range to 1/4 mile or less. Author

N66-15404# Aracon Geophysics Co., Concord, Mass.
METEOROLOGICAL SATELLITE TECHNIQUES FOR THE ARMY First Quarterly Report, 1 May–31 Jul. 1965
P. E. Sherr, R. J. Boucher, W. K. Widger, Jr., C. W. C. Rodgers, and J. C. Barnes Aug. 1965 31 p refs
(Contract DA-28-043-AMC-01273(E))
(ECOM-01273-1; AD-623533) CFSTI: HC $2.00/MF $0.50

The research reported herein was conducted during the first quarter of a contractual investigation aimed at providing the Army field units with techniques for the use of weather satellite data. Results to date for each of several tasks are discussed. These include: (1) mesoscale analysis and interpretation studies; (2) analysis of Army requirements for applications of weather satellite data; (3) case studies of World War II, Korean or U.S. field maneuver synoptic situations, using analogs for which satellite data are available; (4) investigations of methods for determining weather affecting enemy operations; and (5) handbook preparation. Examples of the type of analyses being prepared for the tasks concerned with mesoscale studies, case studies, and weather affecting enemy operations are presented and discussed. No attempt has been made to draw final conclusions from the early stages of the investigations. However, certain areas which seem to hold particular promise have been noted. For example, the simple relationship of total cloud cover (as observed by the satellite once per day) to amount of precipitation over a selected geographical area seems to show a high correlation. Author(TAB)

N66-15409# Pennsylvania State Univ., University Park. Dept. of Meteorology.
FLUX OF HEAT AND MOMENTUM IN THE PLANETARY BOUNDARY LAYER OF THE ATMOSPHERE Final Report, 1 Apr.–31 Jun. 1965
Alfred K. Blackadar, Hans A. Panofsky, Stephen Berman, Jason K. S. Ching, G. Dala Hess et al 31 Jul. 1965 156 p refs
(Contract AF 19(604)-6641)
(AFCRL-65-531; AD-622899) CFSTI: HC $5.00/MF $1.00

A single-layer theory is presented for the wind distribution in baroclinic neutral and unstable boundary layers. The theory predicts the stress of the wind on the ground from large scale geophysical parameters. A re-analysis of observations made by Swinbank confirms the validity of the Keyps wind profile theory. The effects of a change of roughness on the wind profile have been extended to diabatic surface layers. Also a study of the turbulent energy budget showed significant differences between the rate of production and rate of dissipation in the vicinity of a large change of terrain roughness. A graphical procedure for estimating the spectrum of the longitudinal wind component from the height, mean wind speed, surface roughness, and stability has been developed from observed spectra at many locations. Author (TAB)

N66-15454 Joint Publications Research Service, Washington, D. C.

EXTINCT CYCLONE PHOTOGRAPHED FROM A SATELLITE

A. D. Zamorskiy and L. S. Minina *In its* Soviet Studies in Meteorol. and Hydrol. 21 Dec. 1965 p 26–35 refs (See N66-15451 06-13) CFSTI: $3.00

Photographs transmitted from the Tiros 7 satellite of a cloud vortex corresponding to a filled cyclone were analyzed, as it was found that this vortex was over a region where a cyclone had existed recently. The atmospheric process of an extinct cyclone was studied by two methods: frontological analysis, and satellite data analysis of the cloud cover. Findings indicate: (1) There is a residual process in the development in the cyclonic vortex when, in the usual sense, a cyclone no longer exists. (2) Extinct cyclones must be noted in synoptic analysis until complete leveling out of the values of all meteorological elements on surface and high-level synoptic charts. (3) To tie-in satellite data with surface observations, it would be helpful to introduce into observatory practices the reading of the azimuthal distribution of clouds in the observer's field of view. (4) Comparisons of nephoanalysis and synoptic chart data make it possible to detect the nature of many structural characteristics of the cloud cover and the atmospheric processes. M.G.J.

N66-15455 Joint Publications Research Service, Washington, D. C.

A METHOD FOR CORRECTION OF LONG-TERM PRECIPITATION NORMS

L. R. Struzer, I. N. Mechayev, E. G. Bogdanova, and Ye. A. Fedorova *In its* Soviet Studies in Meteorol. and Hydrol. 21 Dec. 1965 p 36–46 refs (See N66-15451 06-13) CFSTI: $3.00

A system is proposed for correcting the monthly and annual precipitation norms for individual observation stations, based on the quantitative dependence of systematic errors of precipitation gauges on the operating factors. The correction is made successively for each error: (1) allowance for precipitation losses due to wetting of the precipitation receptacle; (2) allowance for wind error in precipitation measurements; (3) wind protection of the station. Test computations were made for the corrections to the precipitation norms for several regions with varying climatic conditions. Tabulated results show that the corrections are significant, ranging up to 50% of the measured sum in regions with strong winds and a great amount of solid precipitation. It was also indicated that, in certain cases, the corrected quantity of solid precipitation can be twice as great as the measured value. M.G.J.

N66-15457 Joint Publications Research Service, Washington, D. C.

OUTGOING RADIATION AND THE RADIANT HEAT FLUX

K. Ya. Kondrat'yev *In its* Soviet Studies in Meteorol. and Hydrol. 21 Dec. 1965 p 55–62 refs (See N66-15451 06-13) CFSTI: $3.00

Various studies on the problem of determining the radiant heat flux for the entire thickness of the atmosphere from measurements of outgoing radiation are reviewed. Theories on the correlation between outgoing radiation and the radiant heat flux under nighttime conditions and under different cloud covers are examined. Analyses of the correlation between outgoing radiation and the total heat flux are also discussed. It is pointed out that the correlation between the total radiant heat flux and outgoing radiation is more significant than the correlation between the long-wave radiant heat flux and outgoing radiation. Other computations reveal that a considerable correlation exists between reflected solar radiation and such values as solar radiation absorbed by the atmosphere, effective temperature, and the parameter characterizing the cloud thickness and the height of its upper boundary. The use of meteorological satellites is evaluated, and it is concluded that more reliable data are needed to determine the radiant heat flux from satellite measurements of outgoing radiation. M.G.J.

N66-15690# Miami Univ., Coral Gables, Fla. Inst. of Marine Science.

RADAR HURRICANE RESEARCH Final Report, 1 Sep. 1964–31 Aug. 1965

H. V. Senn, J. A. Stevens, and P. J. Davies Sep. 1965 117 p refs

(Contract Cwb-10970)

Radar hurricane precipitation patterns used as indicators of storm center motion are surveyed. These patters include the open eye; pre-hurricane squall lines and their distance and motion with respect to the storm center; carrot-shaped and other squall lines which seem to form only in certain types of storms; the average number of spiral bands in the storm; the crossing angle of spiral bands at various ranges from the eye; the varying velocity, length, tails, and lifetime of the bands; and the position and structure of the rainshield. The three dimensional distribution of precipitation in hurricane Cleo, 1964 is presented using radar precipitation data obtained in south Florida. These data include PPI in the normal mode, as well as in stepped-gain and video-inversion IEC modes, PPI taken with varying antenna tilts, and RHI data at closely spaced intervals of time. The relative intensity, position and height of the heavier echo cores, as well as the areal extent of the precipitation pattern elements, are also presented. The temperature distribution in the hurricane is discussed theoretically, and a symmetric distribution is derived which has the primary feature of describing the spiral bands and their relative positions within the hurricane. The derived equations should prove useful as an initial temperature distribution in modeling experiments. Author

N66-15800# United Aircraft Corp., East Hartford, Conn.

THE OBJECTIVE ANALYSIS OF HUMIDITY. AN UPPER-AIR HUMIDITY DIAGNOSTIC AND ANALYSIS TECHNIQUE Technical Report, Oct. 1964–Aug. 1965

John T. Ball, Donald A. Chisholm et al Bedford, Mass., AFSC, Electron. Systems Div., Oct. 1965 116 p *Its* Rept.-7463-181 (Contract AF 19(628)-3437)

(ESD-TR-65-15; AD-624135) CFSTI: HC $4.00/MF $0.75

A procedure has been developed to selectively diagnose upper-air humidity from surface observations and to utilize both diagnostic and radiosonde data in an objective analysis of dew-point spread using the successive approximation technique. Northern-hemisphere surface synoptic and radiosonde data from August through October 1964 are used to develop

diagnostic relationships between surface-observed variables at a single station and the dew-point spread at the 850-, 700-, 500-, and 400-mb levels above that station for the warm season of the year. The approach consists of two steps: (1) the isolation within a decision-tree framework of those cases for which individual surface-observed variables yield highly reliable estimates of upper-level humidity; and (2) the application of a statistical technique (Regression Estimation of Event Probabilities) to the remaining cases to derive equations yielding probabilities of occurrence of specified categories of dew-point spread. This approach yields useful diagnostic information of variable quality. Author (TAB)

N66-15861# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
SAMPLING AND DIGITIZING OF METEOROLOGICAL DATA
Roy I. Glass, Jr. Fort Monmouth, N. J., Army Electron. Command, Nov. 1965 16 p refs
(ECOM-5021; AD-624627) CFSTI: HC $1.00/MF $0.50

Requirements exist for higher response meteorological instrumentation and for the digitizing of meteorological data for digital computers. A study of two of the major factors, sensor response and sampling rates, has been made. A method is presented for converting distance constant to equivalent frequency, with the results in terms of an equation. In addition, sampling rate requirements within the framework of information theory considerations are discussed. Author (TAB)

N66-15917# France. Direction de la Météorologie, Nationale, Paris.
CLIMATOLOGY AT HEIGHTS SOUTH OF THE RED SEA AND AERONAUTICAL CLIMATOLOGY OF DJIBOUTI-AERODROME [CLIMATOLOGIE EN ALTITUDE AU SUD DE LA MER ROUGE ET CLIMATOLOGIE AERONAUTIQUE DE DJIBOUTI-AERODROME]
A. Beau, E. Bourhis, and R. Berges Oct. 1965 51 p refs In FRENCH *Its* Monographs-48 CFSTI: HC $3.00/MF $0.50

A climatological profile, including both surface and atmospheric conditions, is given of the Djibouti airfield area and the highlands on the south of the Red Sea. It is based on observations and measurements made between 1953 and 1962. Descriptions, tables, and maps are included, illustrating and showing wind conditions, precipitation, atmospheric temperature distribution, visibility, maximum and minimum mean daily temperatures, humdity, and pressure. Transl. by D.T.

N66-15958# France. Direction de la Météorologie Nationale, Paris.
THE CLIMATE OF AFGHANISTAN [LE CLIMAT DE L'AFGHANISTAN]
Nour Mohammad Herman Oct. 1965 56 p refs In FRENCH *Its* Monograph No. 52 CFSTI: HC $3.00/MF $0.50

A climatological profile, including only surface conditions, of Afghanistan is given, based on observations made between 1958 and 1963. Descriptions and tabulated data are presented for temperature, precipitation, barometric pressure, humidity, and haze. Transl. by D.T.

N66-15961# France. Direction de la Météorologie Nationale, Paris.
CLIMATOLOGY OF THE ISLAND OF TAHITI: SURFACE—HEIGHTS [CLIMATOLOGIE DE L'LILE DE TAHITI: SURFACE—ALTITUDE]
Sep. 1965 178 p In FRENCH *Its* Monograph No. 44 CFSTI: HC $4.00/MF $0.75

A climatological profile of Tahiti and Moorea, including both surface and atmospheric conditions, is given, based on observations made between 1949 and 1963. Descriptions, tabulated data, and analyses are presented of surface pressure, temperature and humidity; precipitation and storms; surface winds; haze and insolation; and ocean currents. Also included are atmospheric wind direction and velocity tables, and the altitudes and temperatures of the various atmospheric layers. Finally, the major storms in the area since 1831 are listed. Transl. by D.T.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N66-15413*# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.
STATISTICAL FILTERING OF SPACE NAVIGATION MEASUREMENTS
James E. Potter and Robert G. Stern Aug. 1963 19 p refs Presented at the AIAA Guidance and Control Conf., Cambridge, 12–14 Aug. 1963
(Grant NsG-254)
(NASA-CR-69287; RE-3) CFSTI: HC $1.00/MF $0.50 CSCL 17G

The criteria that have been used for designing an estimator which computes the state vector of a space vehicle from redundant navigational measurements are reviewed and compared. It is shown that under the assumption of linearity all these criteria lead to the same estimator (or filter). If all measurement uncertainties have Gaussian distributions, it is shown that the estimate obtained from optimum filter theory is identical with the maximum likelihood estimate. A proof is presented that the Bayes estimator, which is biased in favor of the initial conditions, leads to the same result that would be obtained from an unbiased estimator to which six pseudo-measurements, representing the initial conditions, have been added. Although the theory has been applied in the specific area of space navigation, the results obtained are generally applicable to the estimation of multi-dimensional random variables. Author

N66-15777*# RAND Corp., Santa Monica, Calif.
NAVIGATION BY SATELLITE USING TWO-WAY RANGE AND DOPPLER DATA
J. H. Hutcheson, J. D. Mallett, and H. S. Schwimmer Dec. 1965 79 p refs
(Contract NASr-21)
(NASA-CR-69552; RM-4815-NASA) CFSTI: HC $3.00/MF $0.75 CSCL 17G

The primary motivation for this study was the belief that a navigation capability should be developed as a secondary or bonus feature to a communication satellite system since the primary need is for coordination, control and communication. With this objective in mind, this report is concerned with the technology involved in determining a user vehicle's position from a single satellite by obtaining multiple measurements of range and range-rate data. The vehicle can be anything from a submarine to a supersonic transport. The computational method is based on a "six-element fix" where three unknown position components and three unknown velocity components are determined from a set of measurements of range and range-rate data. In principle, it is an orbit determination process in

reverse. A simplified model of the process was developed and tested on a digital computer in order to test for convergence and sensitivities to error when the time interval between measurements was decreased. Many examples were simulated with vehicle speeds ranging from 20 K for surface vessels to 2000 K for supersonic aircraft and satellite altitudes ranging from 500 n mi to synchronous, both polar and equatorial. Results indicate that satisfactory aircraft navigation accuracies may be achieved for orbital altitudes of less than 4000 n mi. Author

N66-16011# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
EVALUATION OF AIR TRAFFIC CONTROL RADAR WEATHER DATA Interim Report
Anthony D. Bradley Oct. 1965 53 p refs
(RD-65-121)

A Technical Evaluation of the ARSR Weather Surveillance System, Type FAA-ER-240-003, was conducted to determine a system performance level which would permit an effective Operational Evaluation. The ARSR Weather Surveillance System, Type FAA-ER-240-003 was designed to process weather informtion received as RF signals at the ARSR-1E antenna and present three distinct iso-amplitude contours of the weather on the Air Traffic Controller's display. An investigation designed to examine the various aspects of the equipment's performance constituted the Technical Evaluation. The ATC Channel circular polarization punch-through level was measured along with the peak intensity of a storm. Contoured weather presentations were photographed and compared with the U.S. Weather Bureau WSR-57 information. It was concluded that a solid line contour, 7 db above the minimum discernible signal and the application of an MSTC-R^3 sensitivity variation with range, established an acceptable system performance level for presenting weather information. The ARSR Weather Surveillance System is suitable for use in conducting an Operational Evaluation. In addition, improvements can be achieved in several system areas. It was recommended that the Operational Evaluation proceed under established operating conditions. It was further recommended that improvements be accomplished in several system areas.
Author

N66-16041# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
MAXIMUM ACCURACY COMPATIBLE DME Final Report
D. Michael Brandewie Sep. 1965 42 p refs
(RD-65-116)

A high accuracy compatible DME system was tested to determine the video and indicator distance readout accuracy on the approach path to NAFEC Runway 13-31. The ground station was modified to operate at high accuracy in the normal DME frequency band. The airborne DME receiver was a high accuracy modified AVQ-70. The flight test results show the video system error and the indicator system error to be well within the ±250-foot tolerance specified. Various design problems were investigated, the worst of which resulted in a mean shift at close ranges due to system overload. Limited tests indicated that the high accuracy DME system is compatible with the VORTAC system. Author

N66-16102# Naval Ordnance Test Station, China Lake, Calif.
HITAB ATTITUDE CONTROL SYSTEM Final Report
William Smith Oct. 1965 35 p refs
(NOTS-TP-3782; AD-623797) CFSTI: HC $2.00/MF $0.50

An attitude control system (ACS) is included in the payload of the Hitab-Aerobee sounding rocket to provide attitude stabilization and controlled maneuverability to the vehicle. It is a ground-oriented, inertially controlled system utilizing two 2-degree-of-freedom gyroscopes to provide the inertial reference. Rate gyro damping is included for stability, while eight cold-gas reaction jets provide the control torques. The system is now manufactured and distributed by the Space General Corporation, El Monte, Calif., for use in the Aerobee 150 sounding rocket. Author (TAB)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N66-15401# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seibersdorf (Austria).
OPERATING EXPERIENCE WITH THE SEMICONDUCTOR-GAMMA-COMPTON SPECTROMETER TO DETERMINE THE BURN-UP AND BURN-UP HISTORY OF NUCLEAR FUEL
M. J. Higatsberger, H. Hick, K. Rumpold, P. Weinzierl, and A. Burtscher 1965 19 p refs
(SGAE-PH-24/1965) CFSTI: HC $1.00/MF $0.50

Measured data obtained with a prototype semiconductor Compton spectrometer, in which a lithium-drifted silicon detector is used, are discussed. Information on the total burn-up, or number of fissions occurring in a fuel element, is identified as being of primary interest, and the difficulties involved in obtaining such measurements are reviewed. Details on construction principles and performance characteristics are summarized. Tests to evaluate the quantitative reliability of burn-up on an actual fuel element indicate that the spectrometer is capable of determining accurately the total burn-up for very small burn-up values. Nondestructive measurements of an irradiated fuel plate were made by the Compton spectrometer, and compared with destructive analyses performed by chemical and mass spectrometric methods. Results indicate that the mean values for the entire fuel plate agree within 0.5%. It was concluded that the Compton spectrometer is suitable for nondestructive measurement of burn-up determination; has comparable accuracy to other methods; and, with proper mechanical scanning arrangements, is capable of obtaining quick and accurate information on burn-up, burn-up history, and fuel migration. M.G.J.

N66-15463# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).
DETERMINATION OF Pu^{239} CONTENT IN NUCLEAR FUEL BY NEUTRON TRANSMISSION TECHNIQUE
F. Putz, T. Al-Khafaji, and P. Weinzierl [1965] 15 p Presented at the Intern. Atomic Energy Agency Symp. on Nucl. Mater. Management, Vienna, 30 Aug.–3 Sep. 1965
(SGAE-PH-28/1965) CFSFI: HC $1.00/MF $0.50

A nondestructive means is proposed for determining plutonium 239 content in a fuel sample as a function of neutron transmission. It is shown that the greater the content of Pu^{239}, the greater should be the transmission of neutrons with an energy of 0.296 eV, which is the energy of the Pu^{239} absorption cross section resonance peak. The method of calculation is given, and graphs are included showing transmission of neutrons at a given energy as a function of the relative quantities of Pu^{239} and other materials. D.T.

N66-15495*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Douglas Missile and Space Systems Div.
AN ACOUSTICAL STUDY OF THE KIWI B NUCLEAR ROCKET
J. Kenneth Manhart, C. M. Ailman, S. R. Lane, and A. H. Marsh Washington, NASA, Jan. 1966 122 p refs
(Contract NASw-596)
(NASA-CR-370) CFSTI: HC $4.00/MF $1.00 CSCL 21F

Sound pressures generated by the exhaust of the KIWI B nuclear rocket engine have been measured and the data analyzed. The characteristics of the radiated sound field that were identified include the: (1) distribution of sound pressures with frequency; (2) distribution of radiated sound power with frequency and total radiated sound power; (3) directivity characteristics; (4) conversion efficiency of exhaust mechanical stream power to sound power; (5) space-time correlation of sound pressures in the near field; and (6) probability distribution of instantaneous peak pressures. These characteristics have been related to the flow parameters of the KIWI B exhaust and, where relevant, to acoustical data and flow parameters of chemical rocket engines. A new method of normalizing the sound power spectra is introduced because the conventional methods did not satisfactorily relate the acoustical data from the KIWI B and chemical rocket engines. On the basis of two data sets from power runs of the KIWI B reactor, the acoustical conversion efficiency of the KIWI B exhaust is shown to be lower than for chemical rockets. In the near-field, the distribution of instantaneous peak pressures was found to be approximately Gaussian. In addition, the response of simple structures to the KIWI B sound field was studied. Comparisons of measured and analytically derived response were made. Author

N66-15503# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
FOCUSING CHARACTERISTICS OF ELECTRIC FIELDS [FOKUSSIERUNGSEIGENSCHAFTEN ELEKTRISCHER FELDER]
M. J. Higatsberger [1965] 25 p refs In GERMAN Presented at the Meeting of the Austrian Phys. Soc., Vienna, Oct. 1965 Submitted for Publication
(SGAE-G-3/1965) CFSTI: HC $1.00/MF $0.50

The basic principles of electrostatic ion and electron optics are briefly reviewed and their application for improvement calculations on cylindrical condensers, flat surface condensers and spheric or toroid condensers discussed. Solutions for Mathieu's differential equations of motion were used to obtain a formula for stable and unstable oscillations of an electric quadrupole field. Also studied were electron optics for rocket ion propulsion principles and for high electron and ion flows in nuclear reactors. Transl. by G.G.

N66-15505# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H. Seibersdorf (Austria). Reaktorzentrum.
RADIOMETRIC AND AUTORADIOGRAPHIC EXPERIMENTS ON THE PRODUCTION OF ASBESTOS CEMENT PRODUCTS [RADIOMETRISCHE UND AUTORADIOGRAPHISCHE UNTERSUCHUNGEN BEI DER HERSTELLUNG VON ASBESTZEMENTPRODUKTEN]
K. E. Duftschmid [1965] 18 p refs In GERMAN
(SGAE-IB/IA-7/1965) CFSTI: HC $1.00/MF $0.50

Mixing processes during the cement-asbestos fabrication were analyzed and guided by radiographic tracings of sodium^{24} isotopes. This method gave exact indications of the optimal asbestos fiber distribution and density during the blending process and thus allowed the control of the finished structures. Transl. by G.G.

N66-15554# Sandia Corp., Albuquerque, N. Mex.
ION PLATING OF SPRF REACTOR PARTS Development Report
D. M. Mattox and R. D. Bland Nov. 1965 21 p refs
(SC-DR-65-530) CFSTI: $1.00

It has been found that SPRF reactor parts are protected from corrosion more effectively by an ion-plated coating of aluminum than by an electroplated nickel coating. Extensive detail is given on the technique of ion plating aluminum on the reactor parts and on observations made during plating. Stripping of the aluminum plating from several of the pieces showed the probable existence of an aluminum–uranium intermetallic, interfacial layer formed during the deposition process. Some possible improvements on the plating process are given based on the experience gained in plating these parts. Author

N66-15571# European Atomic Energy Community, Brussels (Belgium). Scientific Data Processing Center.
FLUB—A 7090 PROGRAM FOR THE DETERMINATION OF LATTICES BUCKLING BY FLUX-MAPPING
R. Di Cola Nov. 1965 27 p refs
(EUR-2551.e) CFSTI: HC $2.00/MF $0.50

The air of the FLUB program is the data processing of ECO flux mapping measurements. The first part of the program makes the different foil activity corrections (background, deadtime of counts, radioactive decay). The second part fits the corrected values to a function of the form:

$$\Phi = A\, J^{o}(\beta r) \sin(\alpha z - \gamma).$$

Author

N66-15584# India. Dept. of Atomic Energy, Bombay.
THE INHOUR RELATION AND EFFECTIVE DELAYED NEUTRON FRACTION FOR MIXED LATTICES
M. Srinivasan 1965 51 p refs
(AEET-222) CFSTI: HC $3.00/MF $0.50

This report deals with the use of the inhour relation in practice, for the conversion of experimentally measured stable doubling times into absolute reactivity values. The problems that arise when the inhour relation is applied to heterogeneous heavy water lattice reactors are considered. The uncertainty in the derived reactivity due to uncertainties in the calculation of some of the constants of the inhour relation have been estimated. The advantage to be gained in doing the conversion of doubling times into absolute reactivity units in two steps i.e. through an intermediate step of a relative reactivity unit, is pointed out. A search is made for a universal relative reactivity-doubling time curve, valid for a wide variety of uranium fueled lattices. Also included in this report is a simple derivation of the inhour equation starting from first principles. Author

N66-15586*# Lockheed Nuclear Products, Marietta, Ga.
DATA COMPILATION AND EVALUATION OF SPACE SHIELDING PROBLEMS. VOLUME I: RANGE AND STOPPING POWER DATA
C. W. Hill, W. B. Ritchie, and K. M. Simpson [1965] 149 p refs
(Contract NAS8-11164)
(NASA-CR-69434; ER-7777, Vol. I) CFSTI: HC $4.00/MF $1.00 CSCL 18F

This report presents tabulations of proton and alpha particle range and stopping power data for 55 materials. The present effort differs from other compilations in that a detailed calculation is performed for both density effect corrections and K, L, and higher shell corrections. Recent experimental values of electron binding energies for the L_I subshell of elements with

low atomic number, 8 through 23, are incorporated in the calculations. Because experimental data adequate to define empirical parameters exist for relatively few materials, an attempt has been made to find smooth variations of these parameters over atomic number and energy. The tabulated data generally agree with available data within experimental accuracy. Author

N66-15587*# Lockheed Nuclear Products, Marietta, Ga.
DATA COMPILATION AND EVALUATION OF SPACE SHIELDING PROBLEMS. VOLUME II: DOSE CALCULATIONS IN SPACE VEHICLES
C. W. Hill, W. B. Ritchie, and K. M. Simpson Aug. 1965 130 p refs
(Contract NAS8-11164)
(NASA-CR-69435; ER-7777, Vol. II) CFSTI: HC $4.00/MF $1.00 CSCL 18F

A computer program system is described which provides an estimate of proton and alpha particle dose within realistic space vehicle configurations. An application of the program system is presented for several interplanetary missions; and program descriptions, operating instructions, and test cases are given. Two of the configurations are interplanetary vehicles containing seven man models; the third is an eight man command module. Operating instructions and descriptions are given for a geometry program, a geometry test program, and a dose program. The geometry program manipulates geometric data and computes penetration thicknesses. The geometry test program scans the input data for character and format errors, checks for certain logical inconsistencies, and plots, off-line, selected cross sections of the geometric representation so that a visual inspection of the configuration may be made. The dose program combines radiation source and geometric data, and computes the dose at the specified detector points. A mission flux code program is included which integrates trapped belt proton and electron flux. C.T.C.

N66-15687# Atomic Energy Establishment, Winfrith (England). Technical Assessments and Services Div.
ZADOC: A TWO GROUP, TWO DIMENSIONAL FUEL MANAGEMENT PROGRAM FOR IBM 7090 OR STRETCH
F. R. Allen Apr. 1965 68 p refs
(AEEW-R-425) HMSO: 8s

ZADOC is a Fortran 2 or S2 language programme for assessment calculations of fuel management on a two-group, two space dimension (x-y) model of a reactor core. The code allows automatic computation of a variety of fuel management schemes ranging from batch operation to on-line refuelling. Author

N66-15843# Portugal. Nuclear Energy Commission, Sacavem.
NUCLEAR FUELS. SOME ASPECTS OF NECESSITY UTILISATION AND IMPORTANCE IN THE NATIONAL PLANNING [COMBUSTIVEIS NUCLEARES. ALGUNS ASPECTOS DE NECESSIDADES, UTILIZACAO E INCIDENCIAS NO PLANEAMENTO NACIONAL]
F. Marques Videira, J. Rocha Cabral (Companhia Portuguesa de Ind. Nucl.), H. Carreira Pich, and H. Machado Jorge 1964 46 p refs In PORTUGUESE Presented at the Coloquio Sobre Participacão da Producão Termoelectrica nas Necessidades Nacionais de Energia Electrica Organizado Pelo Gremio Nacional dos Ind. de Elec.
(LFEN.37 (γ)) CFSTI: HC $2.00/MF $0.50

The purpose of this report is to analyze very briefly some aspects of the utilization of nuclear fuels, particularly as far as national programs are concerned. Types of nuclear fuels, of fuel elements, and of fuel cycles are presented, mention being made of some recent economical data. The problem of world reserves of nuclear fuels is also reviewed. The needs of nuclear fuels corresponding to the hypothetical national nuclear programs, suggested as a basis of discussion for this Coloquium, are calculated. Finally, the installation of the fuel cycle industries in Portugal and the valorization and the utilization of the national uranium reserves are discussed. Author

N66-15870# European Atomic Energy Community, Brussels (Belgium).
EFFICIENCY OF A SEMICONDUCTOR SANDWICH DETECTOR IN A FLUX OF FISSION NEUTRONS FROM A DISK SOURCE
R. A. Rydin Aug. 1965 26 p refs
(EUR-2487.e) CFSTI: HC $2.00/MF $0.50

The detection efficiency of a semiconductor sandwich spectrometer is calculated as a function of energy and distance from a disk type fission neutron source. The efficiency is found to vary with the angular distribution of incident neutrons as well as with the incident neutron energy. The difference between using the actual differential cross sections for the Li^6 reaction and assuming isotropic cross sections is not large. Author

N66-15877# United Kingdom Atomic Energy Authority, Springfields (England). Reactor Fuel Element Lab.
THE NON-DESTRUCTIVE TESTING OF FUEL ELEMENTS AND THEIR COMPONENTS FOR THE U.K. POWER REACTOR DEVELOPMENT PROGRAMME
C. A. Mann and I. C. Campsie 1965 26 p refs Submitted for Publication
(TRG-1031(S))

Test procedures are described in a development program on fuel pins for a number of reactor systems. The sheaths of these pins are tubes in the range 5 to 15 mm diameter, and the materials are stainless steels and zirconium alloys. The procedures are flaw detection in tubes, dimensional inspection of tubes and pellets, and checking the integrity of finished pins. Flaw detection in tubes is accomplished by ultrasonic inspection using two immersed probes. The tubes are traversed helically at high speeds through a stationary tank with flaw signals being monitored and recorded. Spark machined slots on the surfaces of the tubes are used as references in setting up the system and in checking its stability. For dimensional inspection various mechanical, pneumatic, nuclear, and electronic methods of measuring are compared. Relative to checking the finished pins, the integrity of end closures is established by radiography, and leakage tests are conducted with a mass spectrometer. C.T.C.

N66-15879# Société Trefimetaux, Argenteuil (France). Departement des Recherches Métallurgiques.
RESEARCH ON THE ALUMINUM-ALUMINA MATERIAL FRITTOXAL WITH A VIEW TO NUCLEAR APPLICATIONS [RECHERCHE SUR LE MATERIAU ALUMINUM-ALUMINE FRITTOXAL EN VUE DES APPLICATIONS NUCLEAIRES]
R. Biais, J. Moisan, P. Jehenson (EURATOM), and J. Herenguel Brussels, EURATOM, Sep. 1965 26 p refs In FRENCH; ENGLISH summary Presented at the Journées Metallurgiques d'Automne, Paris, 12–16 Oct. 1964
(Contract EURATOM-089-63-1 ORGF)
(EUR-2447.f) CFSTI: HC $2.00/MF $0.50

A comprehensive study was made to improve the characteristics and technology of the sintered aluminum–aluminum

oxide material Frittoxal. The starting powders are prepared by a process for manufacturing degassed products; the degassing of the material being effected before extrusion-sintering by phased heating under 10^{-2}/mm Hg vacuum. This treatment being essential to the material with regard to its compactness, the stability of its properties under protracted heatings at high temperature, and its welding behavior. It is reported that the first phase of the work consisted in selecting the powder grades for fabrication of the fuel element clads and the pressure tubes. Sinters obtained by extrusion-sintering were characterized by cold and hot mechanical tests and by creep tests. It is also reported that studies have enabled certain data to be pinpointed on the annealing of Frittoxal and on the anisotropy of the mechanical properties. An outline is included of research with emphasis on fineness of the starting powder and purity of the basic aluminum.

C.T.C.

N66-15925# Portugal. Nuclear Energy Commission, Sacavem. Div. of Nuclear Reactors.

THREE YEARS OF OPERATION OF THE REACTOR PORTUGUES DE INVESTIGACAO [TRES ANOS DE OPERACAO DO REACTOR PORTUGUES DE INVESTIGACAO]

Antonio Joaquim Goncalves Ramalho 1964 18 p refs in PORTUGUESE; ENGLISH Summary *Its* Publ. do Lab. DE Fis. E Eng. Nucl. Presented at the 27th Cong. Luso-Espanhol Para O Progresso das Cien., Bilbao, Portugal, 20–24 Jul. 1964 (LFEN-26(α); R.7/OE.4) CFSTI: HC $1.00/MF $0.50

The more relevant abnormalities which occurred in the installation are described together with a more detailed discussion of the tests performed on the control rods prior and after its installation in the reactor. It is shown that the effect produced by the movement of some control rods in regions close to the lower limit is reversed and that this situation can be attributed to an insufficient compactness of the B_4C.

Author

N66-15940# Gesellschaft für Kernenergieverwertung, Hamburg (West Germany).

STATIC AND DYNAMIC MEASUREMENTS ON THE DOPPLER EFFECT IN EXPERIMENTAL FAST REACTOR

W. Häfele, K. Ott, L. Caldarola, W. Schikarski, K. P. Cohen (Gen. Elec. Co., San Jose, Calif.) et al Brussels, EURATOM, Dec. 1965 19 p refs Presented at the 3d Intern. Conf. on the Use of Atomic Energy for Peaceful Purposes, Geneva, 31 Aug.–9 Sep. 1964

(Contract EURATOM-009-63-1 RAAD)

(EUR-2484.e) CFSTI: HC $1.00/MF $0.50

On the basis of present knowledge, it appears that the Doppler coefficient will be the only reliable prompt negative feedback mechanism present in fast power reactors. Design of fast power reactors will, therefore, be dependent upon and strongly influenced by a detailed understanding of the behaviour of the Doppler effect under various conditions, in particular operating and accident conditions. There are principally two different tools to determine the Doppler effect in fast reactors: a fast neutron critical facility and an experimental fast reactor. In the present paper the complementary potentialities of the Doppler effect in an experimental fast reactor is discussed. Such a program requires the use of an experimental fast reactor capable of safely undergoing both superprompt critical and subprompt critical excursions. The Southwest Experimental Fast Oxide Reactor (SEFOR) has been designed specifically with this programme in mind. The requirements on the reactor and its design are briefly described. The various tests are discussed in detail. Special attention is given to the physical parameters involved in the evaluation of the Doppler effect and to the precision expected of the final results. Author

N66-15956# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Institut fuer Physik.

STUDY OF THE BEHAVIOR OF GAMMA RAYS IN THE AIR [STUDIE UEBER DAS VERHALTEN VON GAMMASTRAHLUNG IN LUFT]

Maria Tisljar 1965 13 p refs In GERMAN Submitted for Publication

(SGAE-PH-20/1965) CFSTI: HC $1.00/MF $0.50

Gamma radiation scattering effects originating from a far away point source above the ground were studied for their dosimetric effects on shielding requirements. An energy source of 550 KeV increased the radiation factor in an infinite homogeneous medium by 155 for a distance of about 1.4 km. The same factor increased by 1.7 when scattering took place in a semi-finite area under evenly distributed specific activity.

Transl. by G.G.

N66-15971# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.

QUANTITATIVE ESTIMATION OF THE URANIUM DISTRIBUTION IN MTR FUEL PLATES BY GAMMA SCINTILLOGRAPHY

K. Cotterell Aug. 1965 30 p refs

(AERE-R-4950)

An apparatus based on gamma scintillography has been developed to provide quantitative information on uranium distribution in fuel plates. Details of the apparatus, setting-up procedure and the calibration methods are given. The relationship between accuracy and rate of inspection is duscussed together with possible methods of increasing the latter.

Author

N66-15996# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).

DYNAMIC STUDY OF A HEAT EXCHANGER [DYNAMISCHE UNTERSUCHUNG DES WARMEAUSTAUSCHERS]

H. Schmidl et al Apr. 1965 152 p refs In GERMAN; ENGLISH summary *Its* Work Rept. No. 3, 1964

(SGAE-RE-2/1965) CFSTI: HC $5.00/MF $1.00

Various developments are reported on studies undertaken to determine the dynamic behavior of the individual elements of a reactor plant. Experiments conducted on the stationary and dynamic measurements of a heat exchanger with single-phase flow, i.e., with heat transfer from water to water without generation of steam, are described. Two basic problems connected with the turbulence of the liquid are examined: temperature measurement under rapidly changing conditions of the values measured; and disturbance of the measurements by the heavy temperature noise. The results of several measurements are given, and the difficulty of obtaining an accurate radial temperture profile is discussed. The need for improved measuring techniques and automatic data processing is pointed out. Details are also included on the construction of a larger plant for testing steam and water mixtures; its design will permit tests of a heat exchanger with a transfer power of 100 KW, and of an electrically heated test loop with a maximum power of 400 KW.

M.G.J.

N66-16008# United Kingdom Atomic Energy Authority, Windscale (England). Reactor Development Lab.

ODYSSEUS: A TWO-GROUP TWO-DIMENSIONAL FUEL CYCLE COMPUTER PROGRAMME SUITABLE FOR ADVANCED GAS-COOLED REACTORS. PART A: GENERAL DESCRIPTION OF THE PROGRAMME

A. N. Buckler 21 Jun. 1965 19 p refs

(TRG-976(W)) CFSTI: HC $1.00/MF $0.50

A general description is given of a Fortran II computer program (ODYSSEUS) for studying fuel cycles in advanced gas cooled reactors. A variety of automatic and semiautomatic fuel management schemes may be studied, and the factor power output may be shaped to a desired form by differential absorber control or fuel manipulation. Batch refuelling, axial and radial shuffling, and on-line refuelling may be simulated. C.T.C.

N66-16010# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
COMPARISON OF BURN-UP DETERMINATION FOR AN MTR-ELEMENT BY SONDE ACTIVATION AND GAMMA SPECTROSCOPY [VERGLEICH DER ABBRANDBESTIMMUNGEN MITTELS SONDENAKTIVIERUNG UND GAMMA-SPEKTROSKOPIE FUR EIN MTR-ELEMENT]
L. Buba, H. Hick, and K. Rumpold 1965 53 p refs In GERMAN
(SGAE-PH-18/1965) CFSTI: HC $1.00/MF $0.50

Preparation, irradiation, and fuel management experiments are reported with a materials testing reactor. Emphasis is placed on fuel element loss calculations after long periods of use. Comparisons are made by sonde activation and gamma spectrometer measurements. Discussions are included for such topics as the calibration of the Compton spectrometer, and various graphs are presented relative to this. S.B.H.

N66-16104# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HOMOGENEOUS CRITICAL ASSEMBLY WITH PROFILED FUEL LOADING
A. K. Krasin and Ye. I. Inyutin 10 Nov. 1965 11 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), vol. 18, no. 2, 1965 p 175–177
(FTD-TT-65-10609/1+2+4; TT-65-64561; AD-623818) CFSTI: HC $1.00/MF $0.50

A homogeneous critical assembly with profiled fuel loading aiming at the equalization of the energy emission in the active zone is described. Characteristics of the critical assembly, scheme of the critical experiment, neutron flux distributions, and fuel distribution and energy emission are discussed. TAB

N66-16142# European Atomic Energy Community, Brussels (Belgium).
NEUTRON SPECTRA MEASUREMENT IN FAST REACTORS USING FOILS DETECTORS. PART I: THEORETICAL CONSIDERATIONS
R. Dierckx 1965 37 p refs
(EUR-2532.e) CFSTI: HC $2.00/MF $0.50

The theory of a method for measuring neutron spectra in fast reactors by foil activation techniques, and a proposed experiment to test the method, are described. A theoretical simulation of the experiment, illustrated by five calculated examples, permits one to evaluate the usefulness of the method, and to estimate the errors due to the method. The integral of the spectrum can be found with a precision of a few percent depending on the spectrum measured. The differential spectrum obtained was found to be a mean of the real spectrum, from which the real spectrum showed slight local deviations. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N66-15214# Martin Co., Orlando, Fla.
EXCITATION AND DETECTION TECHNIQUES FOR MILLIMETER WAVE TRANSITIONS Final Report, 1 Jul. 1962–1 Jul. 1965
J. J. Gallagher, R. G. Strauch, and R. E. Cupp [1965] 107 p refs
(Contract DA-36-039-SC-90753)
(OR-6653; AD-623463) CFSTI: HC $4.00/MF $0.75

The purpose of this contract is to investigate the excitation and detection techniques for molecular millimeter wave transitions which can be used to develop a frequency standard operating in the region of 200 to 300 Gc. The part of the project concerned with the excitation of molecular transitions is a study of the means of providing a highly stable exciting signal with sufficient power to induce transitions, and an investigation of the resonant structure techniques for exciting the beam. The second part, the study of detection techniques, covers methods of detecting molecular transitions with provision for using the detected signal for frequency control. Author (TAB)

N66-15250*# Northwestern Univ., Evanston, Ill. Technological Inst.
ON THE STABILITY EQUILIBRIUM OF CONTINUOUS SYSTEMS
S. Nemat-Nasser and G. Herrmann [1964] 23 p refs Submitted for Publication
(Grant NsG-605)
(NASA-CR-60702) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A sufficiency theorem for the stability of a linearly viscoelastic solid subjected to partial follower surface tractions is established. It is shown that an appropriately defined functional metric space must be introduced in order to formulate a well-posed problem. The usual energy method, if applicable, and the Galerkin method, if convergent, yield stability conditions only in a functional space whose metric is defined in an average sense. Author

N66-15296*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
HYPERVIRIAL THEOREMS AND THE HELLMAN–FEYNMAN THEOREM IN DIFFERENT COORDINATE SYSTEMS
Saul T. Epstein 12 Feb. 1965 8 p refs Submitted for Publication
(Grant NsG-275-62)
(NASA-CR-60915; WIS-TCI-78) CFSTI: HC $1.00/MF $0.50 CSCL 20J

It is shown that the difference between the Hellman–Feynman theorems in two different coordinate systems is in general a hypervirial theorem. Author

N66-15298# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UKRAINIAN JOURNAL OF PHYSICS Selected Articles

30 Sep. 1965 17 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 9, no. 6, 1964 p 593-598, 659-663
(FTD-TT-646/1+2+3+4; AD-622451) CFSTI: HC $1.00/MF $0.50

CONTENTS:

1. REFLECTION OF ELECTROMAGNETIC WAVES FROM THE OPEN END OF A WAVEGUIDE S. S. Kalmykova 7 p refs (See N66-16299 06-07)

2. PHOTOELECTRIC PROPERTIES OF HETEROJUNCTIONS OF SOME SEMICONDUCTORS Zh. I. Alf'orov, M. S. Zimogorova, O. M. Smol'yanov, and M. K. Tukan 7 p refs (See N66-16300 06-26)

N66-15315*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INTERACTION OF STRUCTURE AND LIQUID IN THE SOUND SUPPRESSOR SYSTEM
Helmut F. Bauer Washington, NASA, Jan. 1966 130 p
(NASA-TN-D-3178) CFSTI: HC $4.00/MF $1.00 CSCL 20A

An analysis of the interaction of structure and liquid of the Saturn V sound suppressor system has been performed. For this reason the liquid response in a rectangular container to translatory excitation has been determined and was described by a mechanical analogon. It was found that more than eighty percent of the liquid mass in the water reservoir sloshes for the fundamental sloshing mode. The natural frequencies of the liquid are extremely low; the fundamental frequency is in the vicinity of 0.2–0.3 or 0.4–0.5 rad/sec depending on the orientation of the excitation. An analysis of the interaction of the liquid and the sound suppressor structure revealed rather low coupled frequencies of 0.22 and 0.74 rad/sec in longitudinal direction (y-direction) and about 0.5 and 6.7 rad/sec in the cross direction (z-direction). It was found that an increase of stiffness does not pay off. Because the cross direction offers the largest structural area, the response of the system to some winds has been treated. Liquid and structural amplitudes are presented for a sinusoidal gust wind of 13 m/sec amplitude, for rectangular pulses of various durations as well as for exponentially decaying pulses of different decay magnitude. Author

N66-15318*# Geophysics Corp. of America, Bedford, Mass
A CONGERIES OF ABSORPTION CROSS SECTIONS FOR WAVELENGTHS LESS THAN 3000 Å
J. O. Sullivan and A. C. Holland Washington, NASA, Jan. 1966 179 p refs Supersedes NASA CR-15. See N63-17313
(Contracts NASw-840; AF 33(615)-1675)
(NASA-CR-371; NASA-CR-15; GAC-TR-64-20-N) CFSTI: HC $5.00/MF $1.00 CSCL 03B

A detailed collection of tables and graphs of absorption cross sections for various wavelengths in the ultraviolet region are presented. They include the following gases for wavelengths less than 3000 angstroms: oxygen, ozone, carbon dioxide, carbon monoxide, water vapor, nitrogen, argon, nitric oxide, nitrous oxide, nitrogen dioxide, ammonia, methane, hydrogen sulfide, and sulfur dioxide. The available data on each gas are given together with a historical sketch of the study of the gas and a list of the pertinent references. Also included is a study of the absorption and photoionization coefficients of the major atmospheric gases at intense and solar emission lines. R.R.D.

N66-15339*# University of Southern Calif. Los Angeles. Dept. of Physics.
OPTICAL CONSTANTS OF BARIUM IN THE VACUUM ULTRAVIOLET REGION
E. I. Fisher, I. Fujita, and G. L. Weissler 15 Aug. 1965 28 p refs (Grant NsG-178-61)
(NASA-CR-69335; USC-VacUV-104) CFSTI: HC $1.00/MF $0.25 CSCL 20F

An ultra-high vacuum reflectometer has been built to operate at about 5×10^{-10} torr. Barium films have been evaporated and their reflectance measured at two angles, near normal incidence at 17.5° and near grazing incidence at 72.5°. The short wavelength limit was determined by the cutoff of the sapphire windows, namely 1500 Å. With the help of the Fresnel equations, the complex dielectric constant has been calculated to yield the index of refraction n and the extinction coefficient k. The imaginary part of (1/s), when plotted against $h\nu$, shows a peak near 7.6 eV and agrees qualitatively with characteristic electron energy loss data. Author

N66-15397*# Michigan Univ., Ann Arbor. Radiation Lab.
DEFINITE AND INDEFINITE FORMS OF MAXWELL'S EQUATIONS FOR MOVING MEDIA
Chen-to Tai [1965] 17 p refs
(Grant NGR-23-005-107)
(NASA-CR-69346) CFSTI: HC $1.00/MF $0.50 CSCL 20C

In a recent article reviewing the electrodynamics of moving media the author compared different formulations with Minkowski's theory and pointed out the importance of the constitutive relations in providing a complete theory. In discussing the constitutive relations, he used merely the first order theory to show the main theme of that paper. In view of the interest and, perhaps, some confusion expressed by several writers on this subject it seems desirable that a more thorough comparison based upon the exact relativistic transformation should be given. Such a comparison may reveal more clearly the intimate relations between various formulations. We emphasize once more that all the latter formulations can be derived from Minkowski's theory by making use of the relativistic transformation on the field vectors. We demonstrate this fact by using the same technique previously illustrated by the method of motional flux, but in a more precise manner. Finally, the exact constitutive relations for various formulations are derived from Minkowski's theory for moving isotropic media. Author

N66-15439*# Michigan Univ., Ann Arbor. Radiation Lab.
ELECTRODYNAMICS OF MOVING MEDIA First Semiannual Report, 1 May–1 Nov. 1965
C. T. Tai, V. Pyati, and R. M. Kalafus 1 Nov. 1965 20 p refs *Its* Rept.-7322-1-T
(Grant NGR-23-005-107)
(NASA-CR-69388) CFSTI: HC $1.00/MF $0.50 CSCL 20C

Progress is reported for three projects dealing with the electrodynamics of moving media. In a study of definite and indefinite forms of Maxwell-Minkowski equations, precise relations are shown between the field vectors in various formulations using only Minkowski's covariant formulation of the electrodynamics of moving media within the framework of the special theory of relativity. Also considered is radiation due to an oscillating dipole over a lossless semi-infinite moving dielectric medium. Solutions to two problems are nearing completion: one involves the determination of radiation field due to a Hertzian oscillating dipole located in a vacuum; this is dependent on a secondary problem, the reflection and refraction of a plane electromagnetic wave incident on the moving dielectric, in which the plane of incidence is not restricted to the yz-plane. The field of a moving charge in a bounded region and the Cerenkov radiation in a waveguide is under investigation. Vector potential is solved by Tamm's and the moving media methods. M.W.R.

N66-15539# Aeronautical Research Council (Gt. Brit.)
THE NOISE OF EJECTORS
D. Middleton 1965 55 p refs Supersedes AASU-247, ARC-25187; See X66-20184
(ARC-R&M-3389; AASU-247; ARC-25187) HMSO: £1 1s 6d

The noise properties of a series of 15 cylindrical ejectors were investigated. A cold 2 in. jet was used with secondary air entrained from the surrounding atmosphere. The five lengths lay between 3 and 32 times the diameter of the primary nozzle, with area ratios of approximately 2, 3 and 4. Emission came from the ejector intake as well as the discharge end, and superimposed on the broad-band 'jet' noise were large discrete-frequency components due to non-linear oscillation within the shroud. In addition, shock noise could occur for supersonic flow. Methods of reducing these are discussed and a comparison made of the present results with other published data on ejector noise. Author

N66-15572# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
MEASURING VERY SMALL ACCELERATIONS [LA MESURE DES TRES FAIBLES ACCELERATIONS]
Pierre Hennion Oct. 1965 124 p refs In FRENCH; ENGLISH summary
(ONERA-TN-89(1965)) CFSTI: HC $4.00/MF $1.00

A study to obtain very low thresholds in acceleration measurement has led us to build a system using forces from electrical fields to suspend a mass through three servo-loops each corresponding to three mutually perpendicular axes. The acceleration of the platform supporting the system initiates a variation of these forces and thus measurement is possible. Experimenting at low levels is carried out in free fall so as to eliminate the action of gravity which would saturate the system. Setting the mass in place at the beginning of the free fall uses the energy of mechanical deformation existing in the physical support of this mass when not in free fall. Author

N66-15573# European Organization for Nuclear Research, Geneva (Switzerland).
LIOUVILLE'S THEOREM AND THE GENERAL PROBLEM OF STABILITY [LE THEOREME DE LIOUVILLE ET LE PROBLEME GENERAL DE LA STABILITE]
J. Fronteau 12 Nov. 1965 44 p refs In FRENCH; ENGLISH summary
(CERN-65-38)

The original form of Liouville's theorem is given, and the link existing between this theorem and Lyapunov's general problem of stability is shown. Further, it is shown that Liouville's theorem forms a link between the behavior of a closed system in (x_i, x_i') space and the relativistic energy exchanges with the external world. Applications are suggested for the theoretical study of accelerators, plasma physics, and radio astronomy. Transl. by D.T.

N66-15614*# Southern Methodist Univ., Dallas, Tex.
MULTIDISCIPLINARY RESEARCH IN SPACE-RELATED SCIENCE AND TECHNOLOGY Semiannual Status Report, 1 May–1 Nov. 1965
J. C. Denton [1965] 42 p refs
(Grant NGR-44-007-006)
(NASA-CR-69484) CFSTI: HC $2.00/MF $0.50 CSCL 20

This report documents the personnel conducting the investigations, the major items of equipment purchases, and the status of the five projects. These projects are (1) investigation of the electrostatic and electrokinetic phenomena of the interface between two immiscible liquids containing soluble electrolytic species; (2) determination of the thermal conductivity of low vapor pressure materials; (3) RC-distributed circuits; (4) impedance characteristics of irradiated thin films; and (5) studies in ultrasonic paramagnetic resonance. E.E.B.

N66-15666*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME ASPECTS OF NOISE ANALYSIS OF INTERFEROMETER SPECTROMETERS
Dale R. Lumb and Gordon C. Augason [1962] 25 p refs
(NASA-TM-X-50671) CFSTI: HC $1.00/MF $0.50 CSCL 20F

This paper analyzes the appearance and distribution of noise on a spectrum obtained by a Fourier transformation of an interferogram which was the source of the spectrum and noise. This is accomplished through a discrete formulation by use of sampling theory and statistical methods. As a consequence of this formulation, a noise comparison of conventional spectrometers and interferometers is readily obtained which verifies that Fellgett's advantage does hold for interferometers with non-background limited detectors. Author

N66-15693# Aerojet-General Corp., Downey, Calif.
INVESTIGATION OF THE COALESCENCE OF WATER DROPS Interim Report, 15 Feb.–15 Aug. 1965
G. J. Woffinden Fort Monmouth, N. J., Army Electron. Labs., Oct. 1965 15 p refs *Its* Rept.-0937-01(01)AP
(Contract DA-28-043-AMC-00497(E))
(ECOM-00497-1; AD-623714) CFSTI: HC $1.00/MF $0.50

An experimental apparatus is being developed for producing droplets 30 to 500 microns in diameter which will impact in mid-air. The coalescence process will be studied with high-speed photography. Author (TAB)

N66-15736# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON NATURAL SCIENCES AND CHEMISTRY [LITERATUUROVERZICHT, NATUURKUNDE EN SCHEIKUNDE]
9 Sep. 1965 48 p In DUTCH *Its* Vol. 16, No. A-386

Abstracts compiled from a literature review of research and development efforts in several countries are presented. Subject matter covered includes acoustics and shock, lasers, optics, photography, solid materials, quantum mechanics, superconductivity, corrosion, surface treatment, plastics, fuels, materials, water and air purification, fire fighting, and packing materials. Technical news items are also included.
Transl. by J.O.

N66-15761# Aeronutronic, Newport Beach, Calif.
ABSORPTION BY CO_2 BETWEEN 6600 AND 7125 CM^{-1} (1.4 MICRON REGION)
Darrell E. Burch, David A. Gryvnak, and Richard R. Patty 25 Jun. 1965 69 p refs
(Contract Nonr-3560(00); ARPA Order 237/11-7-63)
(U-3127; AD-624568) CFSTI: HC $2.00/MF $0.75

The absorption by CO_2 in the 6600-7125/cm region (near 1.4 microns) has been studied with a spectrometer having a spectral resolution of about 1/cm. Spectra were obtained for 38 samples of CO_2 and $CO_2 + N_2$ with pressures as high as 15 atmospheres and paths as long as 933 meters. The strengths of the important bands and the half-widths of several lines have been measured. Photographs of the spectra of all the samples as well as a table of transmittance versus wave number are included. Author (TAB)

N66-15802# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
INTERDISCIPLINARY LABORATORY PROGRAM Annual Technical Report, 1964–1965
1 Nov. 1965 143 p refs
(Contract ARPA SD-90)
(AD-623906) CFSTI: HC $4.00/MF $1.00

Contents: Chemical and solid state physics; Electronic, magnetic, and optical properties of materials and device applications; Metallurgy; Central facilities. TAB

N66-15817*# TRW Systems, Redondo Beach, Calif. Physical Electronics Lab.
SOLID-STATE DETECTOR
D. O. Hansen Aug. 1965 9 p ref
(Contract NASw-936)
(NASA-CR-69576; STL-4158-6018-TU-000) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Utilization of an n-type silicon surface barrier diode as micrometeorite detector was studied. The diode was constructed by evaporating a thin gold film onto high resistivity n-type material and an electron depleted region was formed through application of reverse bias across the n-p junction. When the semiconductor was used on nuclear particles, for every 3.5 ev of energy lost by the particle in the depletion region, an ion-electron pair formed and was then collected by the detector electrodes. Placement of a positive biased grid in front of the grounded p-electrode resulted in electron extraction from the detector and reduced the number of opposite polarity signals significantly. G.G.

N66-15845# Frankford Arsenal, Philidelphia, Pa. Pitman-Dunn Research Labs.
OSCILLATIONS DUE TO A NONLINEAR RESTORING FUNCEION OF THE TYPE $x/(1-x^2)\gamma$
Arnold Leibowitz, Henry Kahn, and Lawrence P. Grayson Sep. 1965 23 p refs
(R-1775; AD-624130) CFSTI: HC $1.00/MF $0.50

Oscillations of a gas-operated oscillator with restoring force are shown to be similar to the motion of the harmonic oscillator. The effects of a spin field are considered relative to the singularities of the system. An analysis is performed, including the effects of viscous damping and deriving amplitude and frequency as functions of time. Author (TAB)

N66-15853# Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.
[FREE-ELECTRON EXCHANGE APPROXIMATION, APW CALCULATION OF X-RAY SCATTERING FACTORS, CONSTANT ENERGY SURFACE FOR GALLIUM, AND ORBITAL AND POTENTIAL EXPANSION] Quarterly Progress Report
15 Oct. 1965 57 p refs
(Contracts Nonr-1841(34); AF 19(628)-356; Grants NSF-G-24908; NSF GP-3241; NSF G-10821)
(QPR-58; AD-623886) CFSTI: HC $3.00/MF $0.75

Note on the free-electron exchange approximation, by J. C. Slater; APW calculation of X-ray scattering factors, by F. J. Arlinghaus; constant energy surface for galliu, by J. H. Wood; orbital and potential expansions, by E. Ellis and P. Ros. Author

N66-15894# Maryland Univ., College Park. Dept. of Physics and Astronomy.
GAUGE PROBLEMS IN CANONICALLY QUANTIZED ELECTRODYNAMICS WITHOUT SUBSIDIARY CONDITIONS
C. S. Lam Aug. 1964 41 p refs
(Grant AF-AFOSR-500-64)
(TR-397; AD-623850)

Relations between time ordered functions of quantum electrodynamics quantized in different gauges are discussed. Author (TAB)

N66-15895# Navy Underwater Sound Lab., New London, Conn.
TABULATIONS OF SLANT RANGE VERSUS HORIZONTAL RANGE FOR BOTTOM-REFLECTED SOUND PATHS
Thaddeus G. Bell and Bernard F. Cole 7 Oct. 1965 78 p
(USL-703; AD-624136) CFSTI: HC $3.00/MF $0.75

When direct timing methods of determining distances are applied to underwater sound reflected from the ocean bottom, slant ranges are obtained instead of horizontal ranges. This report provides a set of tabulations for the conversion of bottom-reflected slant ranges to horizontal ranges for various water depths. The horizontal range is computed from 0 to 90.2 kiloyards for water depths ranging from 1000 to 3600 fathoms in 200-fathom intervals. Author (TAB)

N66-15896# Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Mater.
[RESEARCH CENTERS, RESEARCH PROJECTS IN THE MATERIALS SCIENCES AND APPENDICES ON DEGREES CONFERRED, PUBLICATIONS, AND SEMINARS] Annual Technical Report, 1 Jul. 1964–30 Jun. 1965
[1965] 121 p refs
(Contract ARPA SD-69)
(ATR-5; AD-624126) CFSTI: HC $4.00/MF $0.75

Summaries are given of research progress and results in the following areas: Synthesis and structure studies; chemical and thermodynamic properties; kinetics and phase transformations; crystal defects and defect mechanism; electronic structure and fundamental interactions; electric, magnetic and transport properties; optical properties; mechanical properties. Also included are listings of LRSM academic staff members; research centers; PhD. and M.S. degrees conferred; publications; seminars/symposia. TAB

N66-15911# Eidgenossische Technische Hochschule, Zurich (Switzerland) Institut tür Flugzeugstatik und Leichtbau.
INVESTIGATION OF EFFECTS OF EXTREME STRUCTURAL FLEXIBILITY ON FLIGHT VEHICLES WITH FEEDBACK-CONTROL-SYSTEM STABILIZATION
Hubert I. Flomenhoft 1965 151 p refs Sponsored by NSF and North Am. Aviation, Inc.
(Rept.-7) CFSTI: HC $4.00/MF $0.75

This dissertation presents the results of a study of the effects of extreme structural flexibility on the dynamic characteristics of a flight vehicle that requires an automatic feedback control system for stabilization. The vehicle chosen for this study is a hypothetical missile-type configuration having a long, very slender body with small, rigid aerodynamic surfaces forward and aft, with a first body-bending frequency of one cycle per second, and is to fly at very high dynamic pressure so that aeroelastic instabilities are severe. It is shown that, when the vehicle is unstable in divergence of the coupled pitching and first-bending modes, it can be stabilized with feedback control of the canard surfaces, but feedback control of

the tail is generally destabilizing. Furthermore, control by means of one aerodynamic surface (single-actuator control) cannot stabilize the system when a dynamic instability exists in combination with the pitching static instability. Stability and achievable dynamic performance are highly dependent on the locations and areas of the aerodynamic surfaces and the location of the gyroscope. For canard control, the gyroscope must be located well forward, but somewhat aft of the nose. Author

N66-15932# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ELEMENTS OF THE HIJMANS-de BOER APPROXIMATION TO ORDER-DISORDER THEORY
J. M. Honig 26 May 1965 21 p refs *Its* Tech. Rept.-390
(Contract AF 19(628)-500)
(ESD-TDR-65-226; AD-623806) CFSTI: HC $1.00/MF $0.50

The Hijimans-de Boer approximation scheme to order–disorder theory is reviewed, with special reference to its ultimate application in the area of gas adsorption phenomena. The purpose of the exposition is to provide a more detailed description of the derivation and to assist the reader, wherever possible, in visualizing the fundamental scheme by a pictorial approach. Author (TAB)

N66-15949# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Environmental Sciences Directorate.
ATMOSPHERIC SOUND PROPAGATION NEAR THE EARTH'S SURFACE
Ricardo Pena and Marvin Diamond Ft. Monmouth, N. J., Army Electron. Command, Oct. 1965 20 p
(ECOM-5018; AD-473746)

A study of sound propagation near the earth's surface under relatively calm meteorological conditions showed considerable variation in the pressure of detected waves. This variation was shown to be due to atmospheric effects between the source and detector. The accuracy of determining the elevation angle of the sound source was found to be highly dependent upon the surface temperature. Author (TAB)

N66-15963# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
ON THE USE OF THE MONTECARLO METHOD TO SOLVE PROBLEMS OF INTERPOLATION [SULL'USO DEL METODO DI MONTECARLO PER RISOLVERE I PROBLEMI DI INTERPOLAZIONE]
G. Cortellessa and G. Farchi 15 Apr. 1965 34 p refs In ITALIAN; ENGLISH Summary
(ISS-65/10) CFSTI: HC $2.00/MF $0.50

A method is proposed to fit experimental data with a theoretical curve with parameters to be determined. The parameters of the fit are extracted at random within intervals wide enough to include the solution. The fit is considered good enough if a choice of parameters satisfies a proper statistical test. A program in FORTRAN IV language has been written for the 7040 IBM computer of the Laboratory of Physics. Author

N66-16078*# California Univ., Santa Barbara.
EXPERIMENTAL STUDIES IN ULTRAVIOLET SOLID STATE SPECTROSCOPY Status Report, Jul. 1965–Jan. 1966
William C. Walker [1966] 9 p
(Grant NsG-91-60)
(NASA-CR-69705) CFSTI: HC $1.00/MF $0.50 CSCL 20F

Spectra of KI, NaCl, and KCl at 80° K in the spectral region 5 to 12 eV were obtained by low temperature vacuum reflectometer operating near 10^{-9} torr. All spectra showed new fine structures near the region corresponding to the onset of interband transitions. Low temperature reflection spectra of type I and IIa diamond in the 5 to 12 eV region indicated fine structures in the weak 7 eV peak. NaCl and KI crystals showed strong luminescent characteristics on intrinsic electron recombinations after excitation by ultraviolet radiation. Crystals of NaF, NaI, KF, and KCl did not produce luminescence. An improved uv polarizer employing LiF plates was designed and tested. This device can be mounted on monochromators thus converting them into polarizing monochromators over the spectral range 2000 to 1000 Å. G.G.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N66-15275# Naval Ordnance Lab., White Oak, Md.
RUTHENIUM 106, ZIRCONIUM 95, AND POTASSIUM 40 AT SELECTED OCEAN STATIONS (1960–1965)
Gordon K. Riel, R. A. Pedrick, D. H. Attaway, and J. J. Audet, Jr. Dec. 1965 48 p refs
(NOLTR-65-118; AD-473931)

The concentrations of potassium 40, ruthenium-rhodium 106, and zirconium-niobium 95 in the ocean have been measured by insitu gamma spectrometry at several Western North Atlantic and a few Eastern North Pacific sites between 1960 and 1965. The concentration of natural potassium 40 is proportional to salinity and close to reported average values. The zirconium-niobium 95 activity is due to fallout from nuclear weapons and decreased markedly after the test ban treaty. The ruthenium-rhodium 106 concentration reported is too high to be entirely due to nuclear tests, and shows no rational pattern with time or depth. Author (TAB)

N66-15324*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
A MULTI-CHANNEL DIGITAL PROGRAM GENERATOR FOR SIMULATING CHARGED PARTICLE PENETRATION OF COUNTER TELESCOPES
Richard Weissman Sep. 1964 31 p refs Submitted for Publication Revised
(Grant NsG-179-61)
(NASA-CR-57140; EFINS-64-49, Rev.) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Simulation of charged particle penetration in solid state detectors has been accomplished by stimulating them with two microsecond infrared light pulses. Infrared stimulators have been incorporated in the design of cosmic-ray telescopes for space experiments and a program generator has been designed and built to provide programmed groups of stimulus pulses in which various coincidence and anti-coincidence combinations can be set up in the detectors with a pre-determined choice in each group of amplitude, repetition rate and number of simulated events. The program generator and infrared pulsing circuits are described with consideration given to the logic design and circuitry employed. Other applications of the program

generator are discussed, such as providing serial and parallel binary coded word groups, programmed sets of pulse trains, and/or time delays of fractions of a millisecond up to months in duration, control of or by computer data systems, and general purpose digital system testing. Author

N66-15411*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PARTICLE SYMMETRIES
Jonas Stasys Zmuidzinas 15 Dec. 1965 57 p refs
(Contract NAS7-100)
(NASA-CR-69360; JPL-TR-32-797) CFSTI: HC $3.00/MF $0.50 CSCL 20H

A theory of particle symmetries is proposed based on general principles of quantum mechanics and special relativity. Starting with a modest generalization of the Poincaré group and using techniques of group theory and operator algebras, it is shown how to construct composite-particle state vectors labeled by external (i.e., pertaining to space-time properties) and internal quantum numbers of physical significance. Macroscopic space-time behaves in exactly the same manner under both the Poincaré group and its generalization, the augmented Poincaré group. It is found that there exists a hierarchy of groups, $Sp\ (1) \subset Sp\ (2) \subset Sp\ (3) \subset \ldots$, which characterizes internal symmetries of the composite particles. These groups are all noncompact. However, it is argued that *physical* particle states are characterized by the compact subhierachy of unitary groups $U\ (1) \subset U\ (2) \subset U\ (3) \subset \ldots$. Thus, it is shown that the essential features of fundamental-particle symmetries can be derived in a general way from basic properties of space-time. These results are believed to form a theoretical framework for attacking dynamical problems such as the correlation of masses and spins with internal quantum numbers furnished by the hierarchy of unitary groups. Author

N66-15412# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
ON THE GENERALITY OF THE STABILITY CRITERION AGAINST THE TRANSVERSE WALL INSTABILITY OF RELATIVISTIC BEAMS
E. Ferlenghi 6 Oct. 1965 11 p refs *Its* Nota Interna No. 42
(LNF-65/34) CFSTI: HC $1.00/MF $0.50

The rules obtained for instabilities due to finite conductivity walls for various types of beams are shown to be of a general character, and a method is given for deducing them without a detailed knowledge of the material properties of the wall. The instability rules (but not the rise times of the instabilities) are considered to be independent of the decay law of a signal impressed on the wall by a particle: that is, modifications of the material properties of the wall, obtained by operating directly on the material or by introducing structures in the vacuum tank, modify only the rise times. It is pointed out that in the case of internal structure, the mechanisms which give new instability criteria should be of a quite different type. Previously developed models are used to describe the dynamical problem, and equations are derived to obtain the solution. M.G.J.

N66-15418# India. Dept. of Atomic Energy, Bombay. Nuclear Physics Div.
NUCLEAR DATA ACTIVITIES IN INDIA–II Progress Report
Jul. 1965 44 p refs
(AEET-228) CFSTI: HC $2.00/MF $0.50

Various facets of nuclear research activities are summarized, including theoretical work which deals with quantitative calculations or determination of specific parameters. The studies reported include developments at the Atomic Energy Establishment Trombay; Tata Institute of Fundamental Research; Saha Institute of Nuclear Physics; Laboratories for Nuclear Research, Andhra University; Karnatak University; and Department of Physics, Lucknow University. M.G.J.

N66-15433# Nihon Univ., Tokyo (Japan). Dept. of Physics.
A REFORMULATION OF THE QUARK MODEL IN TERMS OF NEUMANN'S GEMISCH
Osamu Hara [1965] 18 p refs
(NUP-65-13) CFSTI: HC $1.00/MF $0.50

A quark model which is free from fractional baryonic number or fractional electric charge is reformulated by using the Gemisch concept introduced by Neumann. A Gemisch is described as a statistical mixture of a number of quantum mechanical states of dynamically independent states which can be realized by the operation of the superselection rule. Beginning with a linear combination of a number of states, a wave function is defined which describes each of the systems. The quark model can thus be reformulated into a more consistent form in the free case; but it is difficult to extend the model to include the interaction. M.W.R.

N66-15447*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Nuclear Engineering and Science.
RADIATION DAMAGE—ELECTRON IMPACT
F. A. White and D. E. Kraus Sep. 1965 87 p ref
(Grant NsG-371)
(NASA-CR-69381) CFSTI: HC $3.00/MF $0.75 CSCL 20H

A theoretical and experimental study to analyze the charge state of recoil ions produced by direct impact from high energy electrons resulted in the development of successful analyzing apparatus but did not produce any adequate data. These unsuccessful efforts are attributed to the repeated failures of several high gain ion detectors to recover to a stable operating mode within 10 microseconds after the intense bremsstrahlung burst of the R.P.I. Linac (linear accelerator). Although it is recommended that the project be terminated, there were several positive results from the research program, including the development of a new concept and proposed method for identifying exceedingly short-lived fission products. General improvements resulted in the Linac technology and specialized mass spectrometric equipment was developed for use in low current ion detection. Theoretical calculations were obtained of proton induced damage in germanium and silicon. M.W.R.

N66-15502# India. Dept. of Atomic Energy, Bombay. Electronics Div.
FACILITY FOR STANDARDIZATION OF RADIONUCLIDES
U. C. Gupta, P. K. Srivastava, S. C. Misra, N. P. S. Sidhu, K. C. Dhingra et al 1965 38 p refs
(AEET-224) CFSTI: HC $2.00/MF $0.50

This report describes the various techniques and instruments used for the standardization of radionuclides. The standardization procedures are briefly described and the accuracy of the results obtained, using several methods, are tabulated. Standardization of radioactive sources includes the determination of the total disintegration rate and the radiochemical purity of the sample under study. A method by which the disintegration rate is measured directly is called primary. It requires radioisotopes in aqueous solution with specific activity in the range of 0.1 to 1.0 μc/ml. A secondary method depends on prior calibration of the equipment with a standard source. It can handle radioactivity from a few microcuries to a few curies. Author

N66-15536# Bern Univ. (Switzerland).
SPALLATION, FISSION AND NEUTRON CAPTURE ANOMALIES IN METEORITIC KRYPTON AND XENON
K. Marti, P. Eberhardt, and J. Geiss Nov. 1965 63 p refs Submitted for Publication Sponsored by Swiss Natl. Sci. Found.
CFSTI: HC $2.00/MF $0.75

Measurements of the Kr and Xe concentrations and isotopic compositions in five meteorites are reported. Experimental techniques and reproducibility are discussed in detail. In the Stannern achondrite 75% of the total Kr and 30% of the total Xe are due to cosmic ray induced spallation reactions. Also Bruderheim and H-Ausson show distinct spallation components. The isotopic composition of pure spallation Kr is derived as Kr^{78} : Kr^{80} : Kr^{82} : Kr^{83} : Kr^{84} = 0.179 : 0.495 : 0.765 : 1.00 : 0.63 and of spallation Xe as Xe^{124} : Xe^{126} : Xe^{128} : Xe^{130} : Xe^{131} : Xe^{132} = 0.590: 1.00 : 1 45 : 0.97 : 3.9 : 0.9. It is shown that the spallation components found were produced by the cosmic radiation late in the history of the meteorite during a period given by the radiation age. The observed Xe^{126}/Xe^{124} spallation ratio rules out a substantial contribution of spallation products in the xenon of carbonaceous chondrites. The Xe fission spectrum derived by Rowe and Kuroda from Pasamonte is corrected for spallation and the following composition is obtained for fission Xe : Xe^{131} : Xe^{132} : Xe^{134} : Xe^{136} = 0.22 : 1.00 : 1.02 : 1.00. It is shown that neutrons produced by the cosmic radiation during the radiation age can account for the observed effect in Abee and the evidence so far suggests that this is also true for Mezo-Madaras. Author

N66-15568# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
FINAL STATE COULOMB INTERACTION IN QUASI-ELASTIC NEUTRINO SCATTERING ON NUCLEI
C. A. Piketty Nov. 1965 59 p refs
(TH-113) CFSTI: HC $3.00/MF $0.50

We have estimated the transverse muon polarization due to the final state Coulomb interaction for the quasi-elastic process: ν (or $\bar{\nu}$) + nuclei $\rightarrow \mu$ + N + residual nucleus, using a single particle model for the nucleus. Maximum effects of few percents are obtained for small muon energy and far from the quasi-elastic peak. So the final state Coulomb interaction can be neglected and the measurement of transverse muon polarization is a valid test of time reversal invariance. Author

N66-15570# European Atomic Energy Community, Brussels (Belgium). Chemistry Dept.
LITHIUM DRIFTED SEMICONDUCTOR DETECTORS IN NUCLEAR SPECTROSCOPY
G. Bertolini, F. Cappellani, W. Fumagalli, M. Henuset, and G. Restelli Nov. 1965 14 p refs
(EUR-2580.e) CFSTI: HC $1.00/MF $0.50

A short description of the techniques used in the construction and some examples of the utilization of lithium drifted semiconductor detectors in electron and gamma spectroscopy are presented. R.N.A.

N66-15632*# Western Reserve Univ., Cleveland, Ohio.
[FUNDAMENTAL STUDIES ON SEMI-CONDUCTOR RADIATION DETECTORS] Semiannual Status Report, Mar. 1–Aug. 31, 1965
Karl J. Casper et al [1965] 90 p refs
(Grant NsG-655)
(NASA-CR-69479) CFSTI: HC $3.00/MF $0.75 CSCL 20H

CONTENTS:

1. FABRICATION METHODS FOR LITHIUM DRIFTED SURFACE BARRIER SILICON DETECTORS H. M. Murray, J. W. Harpster, and K. J. Casper 27 p refs (See N66-15633 06-24)

2. COMPUTER PROGRAM FOR ANALYSIS OF BETA-RAY SPECTRA MEASURED WITH SOLID STATE DETECTORS 22 p refs (See N66-15634 06-24)

N66-15633* Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
FABRICATION METHODS FOR LITHIUM DRIFTED SURFACE BARRIER SILICON DETECTORS
H. M. Murray, J. W. Harpster, and K. J. Casper *In its* Fundamental Studies on Semi-Conductor Radiation Detectors [1965] 27 p refs (See N66-15632 06-24) CFSTI: HC $3.00/MF $0.75

Described is the vacuum diffusion of lithium onto the surface of a silicon crystal wafer. The lithium metal is evaporated onto the unheated crystal inside a diffusion furnace which is subsequently heated to a temperature of 370° C. After diffusion, the current for the heating coil is turned off, air let into the vacuum immediately, and the wafer is cooled by placing it on a carbon block. Further crystal preparations include stain etching by a mixture of HF and HNO_3, sanding to remove the stain etch, ultrasonic cleaning with trichloroethylene, checking for drift, and the final polish etch. The best lithium surface barrier silicon detectors show reverse currents of less than 1 μa at 100 volts. Detectors fabricated by this method have resolutions between 15 and 30 keV for the 975 keV conversion line of Bi^{207} when operated at room temperature; they are primarily useful for beta-ray and electron measurements. G.G.

N66-15634* Western Reserve Univ., Cleveland, Ohio.
COMPUTER PROGRAM FOR ANALYSIS OF BETA-RAY SPECTRA MEASURED WITH SOLID STATE DETECTORS
In its Fundamental Studies on Semi-Conductor Radiation Detectors [1965] 22 p refs (See N66-15632 06-24) CFSTI: HC $3.00/MF $0.75

The Fortran IV program used for the analyses of beta-ray spectra measured with lithium drifted surface barrier silicon detectors is described. This program contains the following subdivisions: (1) Fitting of the measured spectrum with a polynomial; (2) an iteration procedure using the measured response function of the detector to obtain the undistorted spectrum from the measured spectrum; and (3) computation of the Fermi-Curie plot using the shape correction factor and determination of the endpoint energy by least squares fit. G.G.

N66-15638# Western Ontario Univ., London. Dept. of Physics.
RESEARCH DIRECTED TOWARDS THE STUDY OF ELECTRONIC STRUCTURE, BAND INTENSITIES AND MODES OF EXCITATION OF MOLECULAR SPECIES Final Report, 1 May 1964–30 Apr. 1965
R. W. Nicholls 3 May 1965 25 p refs
(Contract AF 19(628)-4169)
(AFCRL-65-364; AD-623940) CFSTI: HC $1.00/MF $0.50

The experimental research programme embraces studies of: Intensity measurements on molecular band systems; Identification atlas of molecular spectra; Shock tube spectroscopy of powdered solids; Plasma jet spectroscopy; Ion beam spectroscopy; X-radiolysis of gases; Impact flash spectroscopy; Laser excitation of powdered solids. The theoretical research programme embraces studies of: Molecular potentials and vibrational wave functions; Derived quantities of vibrational Wave functions; Atomic collisions. Results of this

research are reviewed with particular emphasis to applications to upper atmospheric physics. A list of the 35 papers resulting from the work is included. TAB

N66-15640*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWO-PHASE HYDROGEN DENSITY MEASUREMENTS BY THERMAL NEUTRON ATTENUATION
Donald F. Shook Washington, NASA, Jul. 1965 11 p refs
(NASA-TN-D-2787) CFSTI: HC $1.00/MF $0.50 CSCL 20H

An experimental evaluation of two-phase hydrogen density measurements by thermal neutron attenuation was made, and the dynamic response to transient-flow situations was determined. Transmission measurements of a polyethylene "mockup" of liquid hydrogen were made, and the beam intensity from many geometric and moderator configurations was determined. The data show that good dynamic measurements can be made with the use of compact polonium-beryllium neutron sources in conjunction with an optimum moderator beam source arrangement. The equipment can be mobile and flexible and can be used to measure the full range of hydrogen mixtures from liquid to gas for a range of pipe diameters. Author

N66-15676# Portugal. Nuclear Energy Commission, Sacavem. Lab. of Physics and Nuclear Engineering.
ANGULAR CORRELATION STUDIES FOR THE $C^{12}(He^3, \alpha\gamma)C^{11}$, $C^{12}(He^3, p\gamma)N^{14}$, AND $O^{18}(p, \alpha\gamma)N^{15}$ REACTIONS
E. K. Warburton, J. S. Lopes, R. W. Ollerhead, A. R. Poletti, and M. F. Thomas 1964 49 p refs
(LFEN-31(β)) CFSTI: HC $2.00/MF $0.50

The particle-gamma angular correlation method of Litherland and Ferguson was used to gain information on the decay modes and spin assignments of the C^{11} 2.00-MeV level; the N^{14} 5.83- and 7.03-MeV levels; and the N^{15} 5.28-, 6.33-, 8.31-, and 8.57-MeV levels. The $C^{12}(He^3, \alpha)C^{11}$, $C^{12}(He^3, p)N^{14}$, and $O^{18}(p,\alpha)N^{15}$ reactions were used to populate the levels. Protons and α-particles were detected in an annular counter at 170° to the beam and gamma rays were detected at angles between 20° and 90° to the beam. The spin of the C^{11} 2.00-MeV level was found to be 1/2, 3/2, or 5/2 with the quadrupole-dipole mixing parameter of the 2.0→0 transition given by $x = +(0.27 \pm 0.07)$, or $|x| > 11$ for 3/2 and $x = -(0.18 \pm 0.07)$ for 5/2. The angular distribution of the N^{14} 7.03→0 transition gave $0.15 \leq x \leq 1.15$ for this J = 2 to J = 1 transition. A 7.03→3.95 transition was observed with a branching ratio of 9 ±5%. The results for the N^{14} 5.83-MeV level were consistent with earlier work. The N^{15} 5.28-MeV level was assigned $J^\pi = 5/2^{(+)}$ with a value of $-(0.15 \pm 0.06)$ or $+(6.1 \pm 1.4)$ for the octupole-quadrupole mixing ratio of the 5.28→0 transition. The N^{15} 6.33-MeV level was assigned $J^\pi = 3/2^{(-)}$ with a value of $+(0.09^{+0.06}_{-0.03})$ or $+(1.4^{+0.1}_{-0.4})$ for the 6.33→0 mixing ratio. Most probably assignments of $(1/2)^+$ and $(3/2)^+$ are made to the N^{15} 8.31- and 8.57-MeV levels on the basis of this and previous work. The results are compared to shell-model predictions. Author

N66-15677# Portugal. Nuclear Energy Commission, Sacavem. Lab. of Physics and Nuclear Engineering.
ANGULAR CORRELATION MEASUREMENTS IN THE $O^{18}(p,p'\gamma)O^{18}$ REACTION
R. W. Ollerhead, J. S. Lopes, A. R. Poletti, M. F. Thomas, and E. K. Warburton 1964 34 p refs
(LFEN-28(β)) CFSTI: HC $2.00/MF $0.50

The levels at 3.92, 4.45, 5.09 and 5.25 MeV in O^{18} have been investigated using p-γ angular correlation measurements in the $O^{18}(p,p'\gamma)O^{18*}$ reaction. The spin of the level at 4.45 MeV has been established as one. This level was found to decay 64 ±5% to the 3.63 MeV O^+ level and 36 ±5% to the 1.98 MeV 2^+ level, with an upper limit of 4% placed on the ground state transition. The 3.92 MeV 2^+ level decayed 5 ±2% to the ground state (O^+), and 85 ±2% to the 1.98 MeV level (2^+). The E2/M1 intensity ratio in the 3.92→1.98 transition was measured as <8%, with a probable value of 3%. The 5.09 and 5.25 MeV levels were found to decay 90% and 60 ±8 % respectively, to the 1.98 MeV level, with ground state transitions of <10% and 40 ±8%. A comparison of levels in O^{18} with T = 1 levels in F^{18} has been made. Author

N66-15685# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
TABLES OF THE FUNCTIONS $X(c_1,\nu)$ AND $X^{\pm}(c_1,c_2)$ FOR THE NUMERICAL SOLUTION OF SLAB GEOMETRY NEUTRON TRANSPORT PROBLEMS, PART I
K. Kowalska May 1965 268 p refs
(Rept.-630/IX-A/PR, Pt. I) CFSTI: HC $6.00/MF $1.50

Tables of the characteristic functions appearing in the solution of slab geometry neutron transport problems, based on the expansion into eigenfunctions, have been prepared. The mean number of secondary neutrons per collision is a variable parameter. Author

N66-15691# European Organization for Nuclear Research, Geneva (Switzerland). Accelerator Research Div.
A MISSING BUNCH PHASE-LOCK SYSTEM FOR PROTON STORAGE RINGS
W. Schnell 2 Sep. 1965 17 p refs
(CERN-65-31) CSCL 20H

The difficulty involved in the application of phase lock beam control to the stacking process in a proton storage ring is described, and a solution is proposed. The essential problem lies in distinguishing between those particles in the bucket, i.e., those which are to be stacked; and those surrounding the bucket, i.e., those which have been stacked. Since this distinction can only be made in longitudinal phase space, a radio frequency beam is used to modulate the longitudinal distribution of the particles in the bucket. However, this same beam also modulates the distribution of particles already stacked. This induces, in the pickup electrode, a voltage out of phase with the reference signal produced by the induction electrode, and the entire phase lock system is perturbed. The proposed solution lies in the separation of the two component voltages: the undesired voltage induced by the surrounding particles; and the one induced by the particles in the bucket. The method of making this separation is discussed for the Cern proton synchrotron. It is also pointed out that the proposed method eliminates the radio frequency noise problem, and the need for switching from phase lock beam control to programmed acceleration. D.T.

N66-15841# India. Dept. of Atomic Energy, Bombay.
NUCLEAR DATA MEASURING FACILITIES IN INDIA
1965 50 p refs
(AEET-227) CFSTI: HC $2.00/MF $0.50

Nuclear data measuring facilities in India are tabulated indicating organization, location, purpose of the measuring apparatus, status, scientist in charge of experimental research, number of staff employed, and publications. Beta ray spectrometers, crystal spectrometers, mass separators and special mass spectrometers, particle accelerators, and pile oscillators are included. E.E.B.

N66-15873# European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
A SONIC SPARK CHAMBER SYSTEM
G. Bellettini, G. Cocconi, A. N. Diddens, R. Donnet, M. Ferrat et al 25 Oct. 1965 113 p refs
(CERN-65-33) CFSTI: HC $4.00/MF $0.75

This report contains a detailed description of a sonic spark chamber system used for measurements of proton scattering in the angular region of 2 to 20 mrad, at energies around 20 GeV at the CERN Proton Synchrotron. Up to 12 events per machine cycle could be recorded, the relevant parameters of each event being written on magnetic tape after having been checked by a small computer on-line. All subsequent calculations were done on a large computer off-line. Author

N66-15885# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
TRANSPORT OF OXYGEN IN OXIDE FILMS ON ZIRCONIUM DETERMINED BY THE NUCLEAR REACTION $O^{17}(He^3, \alpha)O^{16}$
B. Cox and C. Roy Oct. 1965 29 p refs Presented at the Electrochem. Soc. Fall Meeting, Buffalo, 10–14 Oct. 1965
(AECL-2350) CFSTI: HC $2.00/MF $0.50

By the irradiation of zirconium specimens oxidized wholly or partially in 50% O^{17} with He^3 ions, and by measuring the α-particles emitted from the $O^{17}(He^3, \alpha)O^{16}$ reaction as a function of energy, it was possible to determine the concentration of O^{17} as a function of depth in the zirconium and its oxide. Experiments in which oxide films grown in O^{16} were subsequently heated in 50% O^{17} at 400 or 500° C; and experiments in which zirconium layers were evaporated onto the surface of films formed in O^{16}, were oxidized briefly in 50% O^{17} at 400 or 500° C, and then were heated in vacuum at the same temperature, have permitted a study of oxygen transport in growing oxide films directly, without invoking any assumptions about the mechanism of oxidation. Results have shown that the concentration of O^{17} close to the surface never attains more than a small fraction of the saturation value, and that the logarithm of the concentration at any point below the surface decreased approximately linearly with increasing depth; however, the results also gave a straight line on a probability plot. Author

N66-15886# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
PROTON-PROTON INTERACTION IN THE GeV REGION
Yogiro Hama Nov. 1965 54 p refs
(RIFP-49) CFSTI: HC $3.00/MF $0.50

The proton-proton interaction at very small distances is studied by analyzing the elastic scattering data near 2 and 3 GeV. The explicit inclusion of the one-pion-exchange contribution in the high-angular-momentum states and that from the one-boson exchange in the intermediate-angular-momentum states together with the assumption that the absorption coefficients can be represented by a smooth function of the orbital angular momentum l allowed us to determine the phase shifts for lower-angular-momentum states. Three independent solutions have been found at each energy considered which are smoothly connected with solutions at lower energies. The form of the absorption is such that in general its maximum is in the $^1D_2$ state. With respect to the real phase shifts, all of the solutions are consistent with the presence of a strongly repulsive core in the $^1S_0$ state, and solutions have been found which suggest a repulsive core also in the triplet odd states. The strong spin dependence of the interaction is stressed and this is discussed also in connection with the forward scattering amplitude. Author

N66-15929# Illinois Univ., Urbana. Dept. of Physics.
THE ENERGY DEPENDENCE OF THE VECTOR FORM FACTOR IN THE Ke_3 DECAY
G. P. Fisher, A. Abashian, R. J. Abrams, D. W. Carpenter, B. M. K. Nefkens et al [1965] 8 p refs Presented at the Intern. Conf. on Weak Interactions, Argonne, Ill., 25–27 Oct. 1965
(COO-42; AD-623990) CFSTI: HC $1.00/MF $0.50

The results on K (0)e3 decays are reported. Form factors are sought for the reaction $Ke_3 \rightarrow \pi + e + \nu$. TAB

N66-15935# Physics International Co., San Leandro, Calif.
PULSED X-RAY PROMPT GAMMA SIMULATOR Final Report
Franklin C. Ford, Donald Martin, and Bernard Bernstein 29 Nov. 1965 64 p refs
(Contract AF 04(694)-496)
(PIFR-011; AD-624019) CFSTI: HC $3.00/MF $0.75

Nuclear explosions are accompanied by the sudden release of large amounts of energy and highly penetrating nuclear radiation. Protection of a missile system or defense system against the nuclear environment of an enemy nuclear counterburst requires evaluation of the vulnerability to determine possible preventive methods. A pulsed X-ray system was selected as preferable for prompt-gamma simulation. The entire pulsed X-ray complex integrates the functions of the X-ray pulser, radiation shielding, rf shield structures, control and diagnostic systems, and dosimetry, providing a convenient transient radiation effects test facility. The specifications and other data pertinent to the major components and subsystem of the pulsed X-ray facility, as well as to the dosimetry systems, are discussed. TAB

N66-15944# Western Ontario Univ., London. Racetrack Microtron Group.
ELECTRON ENERGY MEASUREMENTS OF THE RACETRACK MICROTRON BEAM
V. Sells, H. Froelich, and E. Brannen Jan. 1965 65 p refs
(Grant AF-AFOSR-297-63)
(RMG-T-2; AFOSR-65-1627; AD-624038) CFSTI: HC $3.00/MF $0.75

The momentum spread in the beam of a racetrack microtron was measured using a high resolution β ray spectrometer. The design of the semicircular double focusing magnetic spectrometer is described. A method of continuous magnetic field measurement in the spectrometer is discussed. The object and image positions relative to the entrance and exit planes of the spectrometer were calculated. The momentum spread in the electron beam of the accelerator as taken directly from the spectrometer was 0.41% at the half width position (full width at half intensity); 0.62% at half current; 1.28% at 90% current and 1.86% at 100% current. These values may be corrected for the natural line width of the spectrometer whose theoretical base spread was 0.16%. With these corrections the upper limit of the energy spread in the 6.0 MeV beam is 22 keV at half width; 34 keV at half integrated current; 73 keV at 90% current and 110 keV at 100% current level. Author (TAB)

N66-15962# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
THE TWO CHANNEL PROBLEM AND THE INELASTIC UNITARITY CONDITION IN EIGENSTATES OF THE TOTAL ANGULAR MOMENTUM [L'UNITARIETA INELASTICA NELLA RAPPRESENTAZIONE DEL MOMENTO ANGOLARE PER UN SISTEMA A DUE CANALI]

U. Amaldi, Jr., R. B. Biancastelli, and S. Francaviglia 10 May 1965 29 p ref
(ISS-65/14) CFSTI: HC $2.00/MF $0.50

In this paper the relations coming from the unitarity of the S-matrix in the inelastic two channel problem are written. If the inelastic contributions are known, the moduli of the elastic amplitudes are obtained starting from the unitarity relations only. A careful study is made of the conditions implied in the inelastic absorptions and in the (real) phases of the elastic amplitudes. Finally the feasibility of the random phases hypothesis is briefly discussed. Author

N66-15973*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
ONE-CENTER AND TWO-CENTER EXPANSIONS OF THE BREIT-PAULI HAMILTONIAN
Peter R. Fontana and William J. Meath 7 Dec. 1965 40 p refs (Grant NsG-275-62)
(NASA-CR-69650; WIS-TCI-125) CFSTI: HC $2.00/MF $0.50 CSCL 20J

The orbit-orbit, spin-spin and spin-orbit Hamiltonians of the Breit–Pauli approximation are expressed in terms of irreducible tensors. One- and two-center expansions are given in a form in which the coordinate variables of the interacting particles are separated. In the one-center expansions of the orbit-orbit and spin-orbit Hamiltonians the use of the gradient formula reduces some of the infinite sums to finite ones. Two center expansions are discussed in detail for the case of nonoverlapping charge distributions. The angular parts of the matrix elements of these Hamiltonians are evaluated for product wave functions. Author

N66-15999# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).
MEASUREMENT OF THE BETA-SPECTRUMS OF Y-90 [MESSUNG DES BETASPEKTRUMS VON Y-90]
Peter Riehs [1965] 12 p refs In GERMAN; ENGLISH summary Submitted for Publication
(SGAE-PH-23/1965) CFSTI: HC $1.00/MF $0.50

The beta-spectrum of Y-90 has been measured by means of intermediate image beta-ray spectrometer and compared with the theoretical unique-first forbidden spectrum form. A factor C $(1 + aW)$ with $a = (-0.0066 \pm 0.0013)/m_e c^2$ fits the deviation from the theoretical form. The endpoint energy of the spectrum was determined to be 2280 ±5 keV. Author

N66-16013 European Organization for Nuclear Research, Geneva (Switzerland). Machine Synchro-Cyclotron Div.
ESTIMATE OF INDUCED RADIOACTIVITY IN ACCELERATORS
M. Barbier and A. Cooper 25 Oct. 1965 153 p refs
(CERN-65-34) CFSTI: HC $4.00/MF $1.25

Extensive calculations are presented of the radioactivity induced in accelerators. In these the activating particles have, in general, a much higher energy, produce spallation, and the induced nuclear reactions have to be included in the computations. Consideration is given to activity induced by high energy nucleons and pions, and an estimation of the total induced activity in high energy electron accelerators. Relative to activity induced by nucleons and pions, such topics as the derivation of Rudstam's formula, tables to facilitate numerical computations, and comparisons with experiments are shown. The total number of photonuclear interactions in a cascade initiated by one electron, the deuteron photodisintegration mechanism, and the photoproduction of π mesons are typical areas examined in the estimation of induced activity in electron accelerators. Tables are included for such data as calculated activity using Rudstam's formula at 1 day cooling time, parameters of the high energy nuclear cascade in various materials, and cross sections for giant resonance reactions. C.T.C.

N66-16029# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Physics.
A SHELL MODEL CALCULATION OF THE ODD TIN ISOTOPES
T. T. S. Kuo, E. U. Baranger, and Michel Baranger (Pittsburgh Univ.) Sep. 1965 76 p refs Submitted for Publication Prepared in cooperation with Pittsburgh Univ.
(Contract Nonr-760(15))
(TR-18; AD-624214) CFSTI: HC $3.00/MF $0.75

A shell-model Hamiltonian with a residual two-nucleon interaction of Gaussian form is used to calculate the states of the odd tin isotopes. The Bogoliubov Valatin quasi-particle transformation is made and the residual interaction is diagonalized in a one- and three quasi-particle space. The spurious states must be projected out. Various approximations to this procedure, such as perturbation theory and a phonon approximation, are studied. Perturbation theory is adequate for low states. The phonon approximation is correct qualitatively, but not quantitatively. The parameters of the residual interaction and the single-particle energies are determined by requiring good agreement with the experimental energies. Magnetic moments, electromagnetic transition rates, and spectroscopic factors are calculated and agree well with the experimental values. Author (TAB)

N66-16031# Harry Diamond Labs., Washington, D. C.
TIME-DEPENDENT NEUTRON TRANSPORT FROM A POINT ISOTROPIC SOURCE AT AN ALTITUDE OF 100,000 FEET
George A. Ausman, Jr. and Francis N. Wimenitz 10 Sep. 1965 309 p refs
(HDL-TR-1305; AD-624041) CFSTI: HC $7.00/MF $1.50

Results of a Monte Carlo calculation of the neutron fluence and flux density in the vicinity of a point isotropic source at an altitude of 100,000 ft (30.48 km) are presented. The fluence and flux density were obtained at 20 detector locations as functions of time and energy for 12 monoenergetic neutron sources. The variation of atmospheric density with altitude is considered in these calculations. A brief discussion of the dependence of the results on detector location is given. Author (TAB)

N66-16144# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
THEORY OF THE NUCLEAR INDUCTION RATE-GYRO [THEORIE DU GYROMETRE A INDUCTION NUCLEAIRE]
Guy Hanuise [1965] 50 p refs In FRENCH; ENGLISH summary
(ONERA-TN-93(1965)) CFSTI: HC $3.00/MF $0.50

The methods for solving Bloch's equations in nuclear magnetic resonance are reviewed and the results are presented in the well-known case of an alternating field perpendicular to the static field. These methods and these results are extended to the case of an alternating field of large amplitude making a small angle with the static field, this configuration corresponding to a nuclear induction rate-gyro. The experimental and theoretical values are compared. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N66-15313*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF A DIRECTED BEAM OF HIGH-SPEED ELECTRONS THROUGH MERCURY VAPORS IN A HEATED-CATHODE DISCHARGE TUBE [ISSLEDOVANIYE NAPRAVLENNOGO POTOKA BYSTRYKH ELEKTRONOV V RAZRYADE S NAKALENNYM KATODOM V PARAKH RTUTI]
V. Polin and S. Gvozdover Jan. 1966 14 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 8, no. 4, 1938 p 436–443
(NASA-TT-F-370) CFSTI: HC $1.00/MF $0.50 CSCL 20I

The electron velocity distribution function in a directed beam is strictly true only near the cathode. Around the cylindrical probe in a discharge ⊥ to the axis a variable nonsymmetric ionic layer forms. Electron reflection is better from a poorly degassed probe than from a completely degassed one. Author

N66-15314*# National Aeronautics and Space Administration, Washington, D. C.
ELECTRON DRIFT IN PLASMA [O DREYFE ELEKTRONOV V PLAZME]
Kh. M. Fataliyev, G. V. Spivak, and E. M. Reykhrudel Jan. 1966 15 p refs Transl. into ENGLISH from Zh. Eks. Teor. Fiz. (Moscow), v. 9, no. 2, 1939 p 167–175
(NASA-TT-F-371) CFSTI: HC $1.00/MF $0.50 CSCL 20I

A method using two probes for determination of the drift of electrons in plasma was used over a wide range of discharge currents. The circuit was arranged to be sensitive to small changes of the probe current. Author

N66-15316*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
BALL LIGHTNING CHARACTERISTICS
Warren D. Rayle Washington, NASA, Jan. 1966 40 p refs
(NASA-TN-D-3188) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Surveys were conducted to obtain information about ball lightning occurrences. A comparison of the frequency of ball lightning observation with that of ordinary lightning impact points revealed that ball lightning is not a particularly rare phenomenon. Contrary to widely accepted ideas, ball lightning occurrence may be nearly as frequent as that of ordinary cloud-to-ground strokes. After obtaining detailed descriptions of 112 ball lightning events, applied correlation techniques failed to pick out any strong connection between factors such as brightness, size, duration, or color. This result, along with the reported constancy of appearance of the balls, makes it appear unlikely that they represent the slow dissipation of stored energy. It is indicated that ball lightning diameter estimates follow a log normal distribution. Such a distribution also represents the quantity of charge in lightning strokes, and has been associated with the field intensities in sferics (electromagnetic disturbances) from thunderstorms. The similarity of these distributions, while certainly not conclusive, suggests that such quantities may be related. Two different categories of events were tentatively identified among those reported in the surveys. In one category, the ball appears after a lightning stroke to ground and remains and ends near the ground. In the other category, the ball is first seen in midair and remains aloft, vanishing without noticeable disturbance. R.R.D.

N66-15346*# Electromagnetic Research Corp., College Park, Md.
A NONLINEAR TECHNIQUE FOR PLASMA DIAGNOSTICS Scientific Report No. 3
W. W. Zachary 30 Nov. 1965 5 p refs
(Contract NASw-835)
(NASA-CR-69290; NAS-835-3) CFSTI: HC $4.00/MF $0.75 CSCL 20I

A new technique for plasma diagnostics is presented which employs the nonlinear properties of the plasma medium. The situation is considered in which two electromagnetic fields with different frequencies ω_1 and ω_2, are externally applied to a plasma. Detailed calculations are carried out for the cases of wave propagation parallel and perpendicular to a static magnetic field. The most promising results, for the purposes of plasma diagnostics, are found in the case of perpendicular propagation. If the work presented herein is extended to include wave propagation directions at any arbitrary angle with respect to the static magnetic field, the corresponding currents will depend on the longitudinal as well as the transverse temperature. It is hoped that the longitudinal temperature can also be measured in this way. This extension is straightforward in principle, involving only more tedious calculations. The diagnostic method proposed in this work should have some advantages over present techniques. This method should enable one to measure anisotropic temperature effects, which is beyond the capability of present probe techniques. Since there are two resonance conditions in the case discussed above, a frequency sweep technique is suggested for measurements of electron temperatures in the ionosphere. Author

N66-15390*# Case Inst. of Tech., Cleveland, Ohio.
A STUDY OF THE THEORY AND MEASUREMENT OF PLASMA DIFFUSION
Gerald A. Otteni (M.S. Thesis) Apr. 1965 89 p refs
(Grant NsG-198)
(NASA-CR-69343; A-35) CFSTI: HC $3.00/MF $0.75 CSCL 20I

A basic introduction to the theory of plasma diffusion is given with references to previous papers in this area. Emphasis is placed on characterizing the diffusion by dyadic diffusion coefficients so that diffusion in the presence of magnetic fields can be included. In the theory, only attachment, ionization and diffusion mechanisms are assumed to exist in the plasma. Solutions are given for plasma distributions in rectangular and cylindrical geometries. An experiment is described which allows the plasma properties to be measured by reflection of a dominant TE_{10} rectangular waveguide mode from a decaying plasma distribution which partially fills the waveguide. Preliminary results in the absence of a magnetic field indicate the presence of a number of resonances in the plasma slab. Author

N66-15427*# Case Inst. of Tech., Cleveland, Ohio.
COLLISIONAL INTERACTIONS OF ENERGETIC TEST ELECTRONS WITH A PLASMA
Michael R. Smith Jul. 1965 96 p refs
(Grant NsG-198)
(NASA-CR-68537; A-39) CFSTI: HC $3.00/MF $0.75 CSCL 20I

An expression for the energy loss rate of an energetic test electron traversing a plasma is derived from a binary collision viewpoint. Energy loss due to the excitation of plasma oscillation is included through an *ad hoc* extension of the maximum impact parameter, $\lambda_D \frac{v}{w_t}$. The solution is generalized to include the effect of a translating plasma. An expression for the distribution of energy losses of a beam of monoenergetic test

electrons traversing a finite plasma is obtained through the solution of a Boltzman equation. The transmission of the beam is calculated using multiple scattering theory. Various aspects of the electron-electron collision problem are discussed. Author

N66-15440*# California Univ., Los Angeles. Plasma Physics Group.
PROPAGATION OF ION ACOUSTIC WAVES ALONG CYLINDRICAL PLASMA COLUMNS
A. Y. Wong Jul. 1965 7 p refs
(Grant NGR-05-007-066)
(NASA-CR-69387; R-1) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Transverse boundary conditions are considered important if the ion cyclotron radius, rather than the wavelength of the ion wave, is comparable to the plasma radius. Examination indicates that the transverse boundary effects on ion acoustic waves can be weakened by the application of a sufficiently high magnetic field which reduces the boundary contribution with respect to the electron contribution in ion acoustic waves. Longitudinal electron plasma oscillations are sensitively dependent upon the boundary conditions since the corresponding ion contribution to the electron oscillations is zero. The independence of ion acoustic waves on transverse boundary conditions can be shown under typical laboratory conditions. M.W.R.

N66-15441*# California Univ., Los Angeles. Plasma Physics Group.
STABILITY LIMITS FOR LONGITUDINAL WAVES IN ION BEAM-PLASMA INTERACTION
Burton D. Fried and Alfred Y. Wong Aug. 1965 31 p refs Sponsored in part by TRW and ONR
(Grant NGR-05-007-066)
(NASA-CR-69377; R-2; STL-9801-6015-RU-000) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The two stream instability is examined for the case of an ion beam traversing a plasma. The dispersion equation for linearized, longitudinal waves in a plasma where collisions are negligible is used to find the restrictions on beam velocity, temperature and density which will lead to growing waves. Author

N66-15508# Toronto Univ. (Ontario). Inst. for Aerospace Studies
THE BEHAVIOUR OF FREE MOLECULE CYLINDRICAL LANGMUIR PROBES IN SUPERSONIC FLOWS, AND THEIR APPLICATION TO THE STUDY OF THE BLUNT BODY STAGNATION LAYER
A. A. Sonin Aug. 1965 169 p refs Sponsored in part by DRB
(Contracts AF 19(628)-363; Nonr-4073(00))
(UTIAS-109; AD-626451)

Experiments were performed to determine the behavior of small, cylindrical Langmuir probes in high-speed flows. Under simulated static conditions, the theory of Laframboise was found to represent the ion current characteristic well when R_p/λ_D (probe radius/Debye length) was large, but not when R_p was comparable to or smaller than λ_D. The ion current decreased with increasing normal velocity, reached a minimum, and then increased again for subsequent increases in velocity. The initial decrease depended on R_p/λ_D, being more pronounced for smaller values of this quantity. The normal velocity did not affect the electron temperature indication. Subsequently, the probes were used in a study of the electron number density and temperature distributions in the stagnation region of a flat-nosed cylinder in supersonic flow. The Reynolds number, Re_2, based on body diameter and stagnation conditions behind the bow shock, was in the range 70 to 125. T_e was found to have a constant value throughout the bow shock and the entire shock layer. The charged particle number density distribution measurements provided a graphic demonstration of the merging of the bow shock and the boundary layer at a value of Re_2 of about 100, and also furnished evidence of the diffusive separation of the ions and atoms in the shock wave. The ion flux to the stagnation point of the model was measured independently and compared with that predicted by high Reynolds number boundary layer theory. Author

N66-15517# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ION CYCLOTRON RESONANCE HEATING OF AN INHOMOGENEOUS PLASMA COLUMN
Masatoshi Tanaka Sep. 1965 34 p refs
(IPPJ-37) CFSTI: HC $2.00/MF $0.50

The ion cyclotron wave is generated in a plasma by a Stix-type induction coil wrapped around the plasma column. The absorbed rf power spectrum is estimated on the basis of the linearized Vlasov–Maxwell equations by taking into account the variations of plasma density and ion temperature over the cross section of the plasma cylinder. Numerical calculations are made for the values of parameters of the QP plasma experiment, assuming the density distribution of a parabolic type. Author

N66-15523# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MEASUREMENT OF THE EXCITATION FUNCTION OF N_2^+ FIRST NEGATIVE BANDS BY ELECTRON IMPACT
Satio Hayakawa, Tiaki Kumazaki, Hiroyuki Nishimura, and Masamoto Otsuka Sep. 1965 24 p refs Submitted for Publication
(IPPJ-42) CFSTI: HC $1.00/MF $0.50

The intensities of lines belonging to the first negative bands of N_2^+ were measured as a function of the energy of bombarding electrons and the pressure of nitrogen gas. The comparison of the intensities of various lines around 4000 A, with and without an interference filter, demonstrated that the filter transparent at 3940 ±100 A is good enough to select the 3914 line from others, provided that the gas pressure is lower than 10^{-3} Torr. As the pressure increases, secondary electrons produced in the gas were found to contribute to the excitation. This can be accounted for in terms of the conventional theory of the secondary electron production and the energy dependence of the excitation cross section of the 3914 line. The latter was found to be approximately reproduced by an empirical formula proposed by Darwin. Author

N66-15535# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab.
SHAPE FACTOR CALCULATIONS FOR TRANSPARENT EMITTER IN CYLINDRICAL GEOMETRIES
Irving L. Traiger Mar. 1965 47 p
(Grant NsG GP-414)
(TR-16)

In order to study the radiation transfer properties of a plasma in cylindrical geometries, shape factor calculations were undertaken to relate the radiation incident on an element of area of the detector to the amount of total radiation emitted from an element of length of the solid cylindrical plasma arc. For these calculations the plasma is assumed transparent, the radiation isotropic, and the intensity of the radiation emission is solely a function of arc radius. Two detection arrangements are considered specifically, although the method can be generalized to any cylindrical system. One arrangement has the detector along the wall of the channel where the plasma is flowing. M.R.W.

N66-15548# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt. Cologne (West Germany).
REPORT ON THE JOINT MEETING OF THE PLASMA FLOWS, ENERGY CONVERTER AND ELECTRICAL PROPULSION SCIENTIFIC PANELS ON 13 DECEMBER 1963 IN STUTTGART [BERICHT UBER DIE GEMEINSAME SITZUNG DER FACHAUSSCHUSSE PLASMASTROMUNGEN ENERGIEWANDLER UND ELEKTRISCHE ANTRIEBE AM 13. DEZEMBER IN STUTTGART]
E. M. Knoernschild and Th. Peters 20 Aug. 1965 86 p refs In GERMAN
(DLR-65-06) CFSTI: HC $3.00/MF $0.75

The following studies are reported: (1) Heating of a plasma flow in an axial electromagnetic field to produce a stationary high pressure plasma at 100000° K temperature; (2) high speed photography of plasma pulsations inside an electric arc and at its exit; (3) plasma acceleration through crossing of electromagnetic fields; (4) plasma acceleration by pulsed electromagnetic transient waves; (5) problems of plasma acceleration with electrodeless generators; and (6) electrostatic propulsion through ionization of cesium on hot, polycrystalline tungsten surfaces. Transl. by G.G.

N66-15606# Innsbruck Univ. (Austria). Institute for Theoretical Physics.
TWO-DIMENSIONAL STEADY AND ONE-DIMENSIONAL UNSTEADY MGD FLOWS OF SMALL MAGNETIC REYNOLDS NUMBER
K. Lackner and F. Cap 3 Feb. 1965 9 p refs
(Contract AF 61(052)-675)
(SR-25; AFOSR-65-1320; AD-622568) CFSTI: HC $1.00/MF $0.50

The applicability of the method of characteristics to the investigation of two-dimensional steady and one-dimensional unsteady MGD flows of small magnetic Reynolds number is studied. Preliminary results are shown to be promising
Author (TAB)

N66-15670# Centre National de la Recherche Scientifique, Meudon (France). Laboratoire D'Aerothermique.
IONIZATION OF A MONOATOMIC GAS BEHIND A DIRECT SHOCK WAVE [IONISATION D'UN GAZ MONOATOMIQUE DERRIERE UNE ONDE DE CHOC DROITE]
Andrzej Lasek Nov. 1965 55 p refs In FRENCH
(Rept.-65-9) CFSTI: HC $3.00/MF $0.50

Classical calculations are presented in a report dealing with the ionization of a monoatonic gas behind a direct shock wave. Up until now it has not been possible to accomplish this at very high temperatures. These high temperatures are encountered in the laboratory in a shock tube which utilizes a magnetic blast. Boundary data are necessary to give a first approximation of the state of the shock layer. A series of calculations is presented, and isentropic law related to ionized argon is considered. Transl. by M.W.R.

N66-15680# Royal Aircraft Establishment, Farnborough (England).
THE RETROGRADE MOTION OF VACUUM ARCS AND LOW-PRESSURE ARCS IN A TRANSVERSE MAGNETIC FIELD
B. Breitholtz Jul. 1965 45 p refs Transl. into ENGLISH from TM-9476 "Vakuum- Och Lagtrycksljusbagars Retrograde Vandring i ett Transversellt Magnetfalt" Vasteras, Allmanna Svenska Elektriska A. B. p 35–59
(RAE-LIB-TRANS-1117) CFSTI: HC $2.00/MF $0.50

This memorandum describes the equipment and the experiments to determine the velocity and direction of motion of vacuum arcs in a transverse magnetic field on oxide-free and gas-free copper electrodes. In order to get as little desorbed gas as possible during a test, the cathode was baked at 800° C for 1–2 hours. In a transverse magnetic field $150 < B < 500$ G and for currents $50 < I < 800$ A the vacuum arc moves in the retrograde direction with velocities in the range 1–20 m/s. The equipment and technique are suitable for an investigation of the velocity of low pressure arcs on oxide-free and gas-free cathodes. A number of measurements was made with argon in the pressure-range $10^{-3} < p < 200$ mm Hg. These measurements show that the retrograde velocity is a decreasing function of argon pressure when $p > 10^{-2}$ mm Hg and B = const. When $I > 200$ A, $p > 10^{-2}$ mm Hg and B = const. it is possible for the arc to move with at least two different velocities. A discussion of the experimental results for $p < 5 \cdot 10^{2}$ mm Hg is made, based on the qualitative model of retrograde arc motion. Author

N66-15699# Stanford Univ., Calif. Microwave Lab.
INTERACTION OF MICROWAVES WITH MATTER Final Technical Report, 1 May 1963–30 Sep. 1964
M. Chodorow and H. J. Shaw Aug. 1965 23 p refs
(Grant AF-AFOSR-322-63)
(ML-1357; AFOSR-65-1964; AD-624102) CFSTI: HC $1.00/MF $0.50

Contents: A perturbation method for waves in timevarying plasma; Radiation from plasma oscillations in inhomogeneous plasmas; Optical spectroscopy of laser materials; Frequency multiplication and amplification using doppler shift methods in solids; Theoretical studies in solid state physics; Transient behavior of solid state lasers; Thermomagnetic phenomena in the quantum region. TAB

N66-15738# Nagoya Univ. (Japan). Inst. of Plasma Physics.
COLLISION-INDUCED INSTABILITY IN A MAGNETOACTIVE PLASMA
Noboru Shimomura, Kenji Mitani, and Shigetoshi Tanaka Nov. 1965 37 p refs Submitted for Publication
(IPPJ-43) CFSTI: HC $2.00/MF $0.50

The dispersion relations for the waves propagating in a magnetoactive plasma are obtained from the Boltzmann equation with a collision term of the electrons. Two cases in which the wave vector parallel and perpendicular to a uniform magnetic field are studied. Assuming a δ-function for velocity distribution function, in each case, we have two dispersion relations for the zeroth approximation in k as follows:

$$(A)\ \omega(\omega + i\nu)^2 = \omega_p^2(\omega + i\nu - i\frac{V}{3}\frac{d\nu}{dV}$$

and $$(B)\ \omega(\omega \pm \omega_c + i\nu)^2 = \omega_p^2(\omega \pm \omega_c + i\nu - i\frac{V}{3}\frac{d\nu}{dV}$$

where ω_c, ω_p and ν are the cyclotron, the plasma and the collision frequency respectively. After detailed calculations under the assumption $\nu(v) = \text{const.} \times v^h$ it is found that the initial perturbation grows exponentially for $h<-3$ in (A) and $h>3$ in (B), and that the growth rate of the latter case attains its maximum value at Re $(\omega)=\omega_c$ to a larger frequency and Im (ω) grows more, but their corrections decrease with the ration ω_c/ω_p increasing. Author

N66-15754# TRW Systems, Redondo Beach, Calif. Physical Electronics Lab.
ELECTROFLUID HYPERSONIC RESEARCH First Quarterly Report

S. M. Zivi 23 Jul. 1965 23 p refs
(Contract AF 33(615)-2118)
(STL-4436-6002-SU-000; AD-624563) CFSTI: HC $1.00/MF $0.50

The purpose of the research is to determine the feasibility of producing a continuous hypersonic flow of air by the electrostatic acceleration of charged frozen air particles, with the subsequent vaporization of these particles. TAB

N66-15785# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NON-LINEAR MOTION OF TWO ION STREAMS IN A BACKGROUND OF HIGH TEMPERATURE ELECTRONS
Tosiya Taniuti, Nobuo Yajima, and Akizi Outi Oct. 1965 29 p refs
(IPPJ-41) CFSTI: HC $2.00/MF $0.50

Non-linear ion acoustic waves propagating in a plasma of warm electrons and one or more streams of cold ions are investigated. A hydrodynamical model which employs ion fluid streams interacting among themselves through the electron pressure gradient is used, isothermal electrons are assumed. Though the present model assumes charge neutrality, it enables us to show how large amplitude disturbances become steeper, tending to form shocks or inversely how discontinuous initial disturbances are smoothed out. For a single fluid, the behavior is the same as those of isentropic gas with γ equal to unity. However, for multicomponent cases there exist conspicuous properties such as multi-stream instabilities. This paper discusses all these effects for the case of two streams. Simple waves are obtained by means of the method of characteristics; for the wave propagating faster than all the ions the compression leads to shock formation while the expansion to the instability, for the wave slower than all the ions the expansion leads to the shock formation and at the same time to instability and for the wave propagating with intermediate speed the situation is more complicated. Author

N66-15799# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NEGATIVE CONDUCTIVITY IN PARTIALLY IONIZED GASES
Shigetoshi Tanaka, Tadao Honzawa, and Kazuo Takayama Oct. 1965 19 p refs
(IPPJ-40) CFSTI: HC $1.00/MF $0.50

The amplification of radio-frequency signal was observed in partially ionized gases, having large Ramsauer effect, in the absence of magnetic field. By adjusting the dc grid current, we observed a strong attenuation, an amplification of the applied rf signal and strong emission with no input signal. This phenomenon occurred when the working frequency was in the range from about 10 to 70 Mc/s, which was somewhat smaller than the collision frequency of plasma electrons. It is considered that experimental results are interpreted as a phenomenon of the negative conductivity due to bremsstrahlung in plasmas. Author

N66-15897# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
HALL EFFECT IN A COLLISION-DOMINATED GASEOUS PLASMA Technical Report No. 1
C. L. Chen [1965] 29 p refs Submitted for Publication
(Contract Nonr-4725(00))
(Rept.-65-9E2-511-P1; AD-624165) CFSTI: HC $2.00/MF $0.50

A theoretical treatment of the Hall voltage developed in a gaseous plasma immersed in a uniform magnetic field is presented. The plasma considered is collision dominated and is confined by parallel planes with insulating walls. The Hall voltage is found to depend on electron-ion volume recombination and on the tensor character of the electron mobility. The cases to be discussed are: (1) negligible diffusion, (2) negligible electron-ion volume recombination, and (3) diffusion with small but not negligible volume recombination. Author (TAB)

N66-15923# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
PRODUCTION AND BEHAVIOUR OF A MAGNETICALLY STABILIZED HIGH-DENSITY HIGH-TEMPERATURE PLASMA
H. Wulff Aug. 1965 16 p refs Repr. from Proc. 7th Intern. Conf. on Phenomena in Ionized Gases, Belgrade, 1965
(MPI-PAE/P1-12/65) CFSTI: HC $1.00/MF $0.50

In a newly developed linear device a plasma is produced and stabilized magnetically for a length of up to 70 cm and for a total discharge time of 2 msec during which the plasma current and the magnetic field strength are kept constant. Depending on the magnetic field strength, plasma current, contamination of the plasma and other parameters the plasma appears in a steady or an unsteady state. It does not come into contact with the wall in either case. The electron density obtained is about 10^{16} cm^{-3}, the maximum temperature exceeding 200 000° K. Author

N66-15924# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
STARK BROADENING OF THE PASCHEN LINES
C.-R. Vidal Aug. 1965 22 p refs Repr. from Proc. 7th Intern. Conf. on Phenomena in Ionized Gases, Belgrade, 1965
(MPI-PAE/P1-13/65) CFSTI: HC $1.00/MF $0.50

The Stark broadening of the Paschen lines ($6 \leq n \leq 13$) is measured photoelectrically with an accuracy of 5% at an electron density $N_e = 1.3 \times 10^{13}$ cm^{-3} determined from the distant line wing of the Balmer lines H_4 to H_{14}. It turns out that the impact broadening of the electrons has only a very small influence on the broadening of the lowest measured series members. The measured profiles are slightly narrower than quasi-static profiles, which take into account the mutual interaction of the disturbing particles and which are smeared out in the line center, maintaining normalization. Author

N66-15931# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLASMA ION SOURCES
M. D. Gabovich 14 Oct. 1965 176 p refs Transl. into ENGLISH from the book "Plazmennyye Istochniki Ionov" Kiev, Naukova Dumka, 1964 p 1-223
(FTD-MT-65-229; AD-623822) CFSTI: HC $5.00/MF $1.00

The book is a survey of source material on gasdischarge ionic sources. It includes different types of plasma ionic sources: sources of atomic and molecular ions of hydrogen, multiply charged ions, electrons, and other particles, and also the extraction of ions and primary forming of ion beams, going in a vacuum of quasi-neutral ionic fluxes, the role of oscillatory properties of plasma and others. TAB

N66-15960# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
REFLECTIONS ON THE MOTION OF TOROIDAL PLASMAS IN A MAGNETIC FIELD [BETRACHTUNGEN ZUR BEWEGUNG EINES TOROIDALEN PLASMAS IM MAGNETFELD]

W. Lotz, F. Rau, and G. H. Wolf Jul. 1965 12 p refs In GERMAN; ENGLISH summary
(MPI-PAE/PI.11/65) CFSTI: HC $1.00/MF $0.50

The plasma of a toroidal theta-pinch in a purely azimuthal magnetic field is not in equilibrium as there is a force acting antiparallel to the field gradient. The mean radial acceleration is

$$\overline{b_R} = \frac{2kT(1+Z)}{m_i \overline{R}}.$$

There are additional forces that tend to deform the plasma. In the case of pure surface currents the acceleration b_z perpendicular to the plain of the torus is

$$|b_z| = \frac{r_p}{R}\overline{b_R}.$$

Author

N66-15976*# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
PROBLEMS IN J × B PLASMA ACCELERATOR Semi-annual Progress Report
James A. Fay 1 Jan. 1966 13 p refs
(Grant NGR-22-009-052)
(NASA-CR-69659) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Progress is reported on shock tube accelerator experiments, heat transfer gauge development, homopolar accelerator theory, and transport effects in boundary layers. An order of magnitude analysis of the Hartmann boundary layers on the insulating faces of the discharge chamber shows that the joule heating of the ions in this layer could be conducted to the interior of the chamber, as well as to the wall, and thus maintain the ionization of the rotating plasma, which tends to disappear due to diffusion to the wall and radiative recombination. The electrons act as the medium for transmitting the thermal energy of the ions to the atoms which are thereby ionized. The Hartmann boundary layer equations for this case were formulated in the form of the grad moment equations in the transport limit.
E.E.B.

N66-15979*# College of William and Mary, Williamsburg, Va. Plasma Physics Lab.
BIMODAL-CAVITY MEASUREMENT OF THE MICROWAVE FARADAY EFFECT IN A GASEOUS MAGNETOPLASMA Technical Report No. 2
M. T. Raiford (M.A. Thesis) Jun. 1963 54 p refs
(Grant NsG-106-61)
(NASA-CR-69655) CFSTI: HC $3.00/MF $0.50 CSCL 20I

Faraday rotation of microwaves in a magnetized plasma has been observed using a microwave cavity technique. The positive column of a gaseous discharge was placed coaxially within a cylindrical cavity, with a magnetic field applied along this same axis. The cavity was excited in the angularly dependent TE_{111} mode, which is doubly degenerate, at a frequency in the neighborhood of 2000 MC. An input antenna was coupled to one of the degenerate modes and an orthogonal output antenna coupled to the other. Theory shows that the power coupled to the output is proportional to the absolute square of the off-diagonal element of the conductivity tensor of the anisotropic plasma. This gives a curve of output power as a function of magnetic field which is strongly dependent on collision frequency and also dependent on electron density.
Author

N66-16091*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEASUREMENTS OF RESONANT CHARGE EXCHANGE CROSS SECTIONS IN NITROGEN AND ARGON BETWEEN 0.5 AND 17 eV
Billy J. Nichols and Fred C. Witteborn Washington, NASA, Feb. 1966 36 p refs
(NASA-TN-D-3265) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The cross sections for charge transfer between N_2 molecules and N_2^+ ions and A atoms and A^+ ions have been determined within the energy range 0.5 to 17 eV. The variation of the cross section (σ) with energy (E) may be approximately represented by an expression of the form

$$\sigma^{1/2} = a - b \ln E$$

which is characteristic of symmetric resonance charge transfer. If E is measured in electron volts, then the values obtained for the nitrogen reaction were $a = 6.48 \times 10^{-8}$ cm, and $b = 0.24 \times 10^{-8}$ cm, and for the argon reaction $a = 7.49 \times 10^{-8}$ cm, and $b = 0.73 \times 10^{-8}$ cm. Departures from the logarithmic behavior were noted in the nitrogen data. These differences consisted of a small hump at an incident ion energy of 8.5 eV and a steady increase of σ over the logarithmic expression below 3 eV. At 1 eV the measured cross section between N_2 and N_2^+ was 59×10^{-16} cm^2. Author

N66-16138*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
A MAGNETOGASDYNAMIC POWER GENERATION STUDY Summary Report
F. H. Shair 20 Jan. 1966 60 p refs
(Contract NAS3-6260)
(NASA-CR-45575) CFSTI: HC $3.00/MF $0.50 CSCL 20I

Experiments were performed with an electron beam to increase the electrical conductivity of a cesium-seeded argon plasma above the thermal equilibrium value in a subsonic duct at neutral particle temperatures up to 1500°K and pressures of the order of one atmosphere. Microwave interferometer diagnostic techniques indicated an electron density up to twenty times the Saha equilibrium value and a low electron density recombination rate which was supported, in qualitative trends at least, by theoretical analysis. Other subsonic experiments conducted with applied electric and magnetic fields and using cesium and cesium–mercury (Penning) seed mixture indicated the existence of low net induced voltages, while experiments with only applied electric fields showed the influence of several types of cathode material and a relatively insensitive dependence of performance on seeding rate. Calculations were also performed to determine the seed concentration required to obtain the optimum electrical conductivity for a MHD generator operating in the non-equilibrium mode. The results indicated a reduction in the seed concentration as compared to the equilibrium situation. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N66-15207# Stanford Univ., Calif. Microwave Lab.
CARRIER WAVES IN SEMICONDUCTORS

Gordon S. Kino Griffiss AFB, N. Y., RADC, Nov. 1965 50 p refs
(Contract AF 30(602)-3595)
(ML-1353; RADC-TR-65-347; AD-624090) CFSTI: HC $2.00/MF $0.50

Mechanisms for achieving low loss propagating carrier waves in bulk semiconductor are considered. General relationships are derived, and three particular specializations for wave propagation under consideration of boundary conditions imposed by thin samples, and finally an analysis which includes inductive effects in semi-conductors and predicts a gain mechanism. Author

N66-15217# Stanford Univ., Calif. Microwave Lab.
CONDUCTION PROCESSES, NORMAL MODES, AND DRIFT INSTABILITIES IN BULK SEMICONDUCTORS
Tore Wessel-Berg Griffiss AFB, N. Y., RADC, Nov. 1965 146 p refs
(Contract AF 30(602)-3595)
(ML-1315; RADC-TR-65-393; AD-624089) CFSTI: HC $4.00/MF $1.00

A general small-signal analysis of wave propagation in semiconductor materials due to drifting majority carriers and electromagnetic fields is presented. The theory is basically independent of details of energy band structure and minority carriers, and is expressed in terms of macroscopic averages of the carrier distributions. The theory is expressed in terms of independent normal modes of wave disturbances in a uniform finite-diameter cylindrical semiconductor. Author (TAB)

N66-15300 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHOTOELECTRIC PROPERTIES OF HETEROJUNCTIONS OF SOME SEMICONDUCTORS
Zh. I. Alf'orov, M. S. Zimogorova, O. M. Smol'yanov, and M. K. Tukan *In its* Ukrain. J. of Phys. 30 Sep. 1965 7 p refs
(See N66-15298 06-23) CFSTI: HC $1.00/MF $0.50

Contents: Reflection of Electromagnetic Waves from the Open End of a Waveguide, by S. S. Kalmykova; Photoelectric Properties of Heterojunctions of Some Semiconductors, by Zh. I. Alf'orov, M. S. Zimogorova, et al. TAB

N66-15310# General Electric Co., Schenectady, N. Y. Research and Development Center.
ELECTRICAL CONDUCTANCE IN ORGANIC SOLIDS Biannual Technical Report, 1 Apr.–30 Sep. 1965
[1965] 13 p refs
(Contract DA-31-124-ARO(D)-175; ARDA Order 462)
(AROD-4642-5; AD-473994)

This report outlines progress made on a two-year program to study the electrical characteristics of some organic solids. The work is divided along three general lines: (1) the study of the transport of carriers injected into insulating (or poorly conducting) solids by an electron gun, (2) a series of electrical measurements on a highly conducting ion radical salt of tetracyanoquinodimethan, and (3) the study of carrier transport in some amorphous systems. A cryostated electron gun system has been designed, and construction is nearing completion. This device should enable us to make transport measurements in a variety of insulating materials between 4 and 300 K. Three techniques for determining the temperature coefficient of resistance of semi-metallic TCNQ salts have been investigated: (1) A. C. bridge methods for polycrystalline samples, (2) four-point-probe measurements on single crystals, and (3) microwave power loss in either polycrystalline or single crystal samples. Only the last appears promising, and further experiments with it are in progress. Author (TAB)

N66-15321*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CURRENT DISTRIBUTION IN AN ARRAY OF SUPERCONDUCTING THIN FILMS
I. D. Skurnick, J. H. Simmons, and A. R. Sass (RCA) Washington, NASA, 1965 18 p refs Presented at the 3d Intern. Conf. on Nonlinear Magnetics, IEEE, Washington, D. C., 21–23 Apr. 1965
(NASA-TM-X-52080) CFSTI: HC $1.00/MF $0.50 CSCL 20L

The conservation of fluxoid approach is used to derive the integral relations describing the current distribution in a general array of cylindrical superconductors. This approach highlights properties of the kernel of the integral equation which permit the development of analytic solutions for a 2×2 array of closely spaced thin films of rectangular cross section. It was found that the current density exhibits a nonlinear, and nonsymmetric peaking at the edges of the films. This peaking, in turn, dictates the switching characteristics of the system. It is shown that the dependence of the peaking on the separation distance between adjacent films can cause considerable variations in the critical current of the system, I_c, as the separation distance is varied between one and 20 times the film thickness. Author

N66-15331*# Illinois Univ., Urbana. Dept. of Physics.
NEGATIVE PHOTOCONDUCTIVITY ASSOCIATED WITH IMPURITY CONDUCTION IN GERMANIUM
E. A. Davis [1965] 16 p refs
(Grant NsG-228-62)
(NASA-CR-69334) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Photoconductivity in germanium has been studied at temperatures and doping levels at which impurity conduction processes are important. Under certain conditions negative photoconductivity is observed. Results as a function of intensity and wavelength are explained by a simple model which is consistent with accepted views of impurity conduction. Author

N66-15383*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Nuclear Engineering and Science.
RECOVERY OF ELECTRICAL PROPERTIES IN 45 MEV ELECTRON-IRRADIATED N-TYPE SI FROM 80°K to 350°K
L. J. Cheng and J. C. Corelli [1965] 27 p refs
(Grant NsG-290)
(NASA-CR-69338) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Isochronal annealing from 80° K to 360° K of defects induced by 45 MeV electrons in floating zone and pulled N-type silicon was studied using electrical properties, namely conductivity and carrier concentration. The results indicate that the annealing behavior in this temperature range depends on the imperfections present in the samples, before irradiation. In particular, oxygen impurities are found to have a pronounced effect on the defect production and annealing process. The total number of silicon A-centers produced after irradiation at 80° K and measured after anneal to 350° K yield production rates of 0.2 to 0.3 cm^{-1} which depend only slightly on the impurity concentration of the samples studied 3×10^{13} to 3×10^{15} phosphorous atoms/cm^3). The production rate of A-centers by 45 MeV electrons is comparable for 80°K and 300°K irradiation. The production of A-centers in 15° K irradiation is found to be about one half the value measured in 80°K irradiations. A comparison of the characteristics of defects induced by 45 MeV and 1–4.5 MeV electrons in silicon will be given. Author

N66-15417# International Union of Pure and Applied Chemistry, Basle (Switzerland). Sub-Commission on Condensed States.

BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS IN THE CONDENSED STATE, VOLUME 1964, NUMBER 4, OCTOBER–DECEMBER 1964

Jacob J. Diamond, ed. (NBS) [1964] 68 p refs

Publications relating to high temperature chemistry and physics of materials in the condensed state are listed. The bibliography is grouped according to (1) devices for achieving temperatures above 1500°C, for measuring and controlling temperatures above 1500°C, and for physical measurements at temperatures above 1000°C; (2) properties of metallic, nonmetallic, and mixed materials at temperatures below 1000°C of materials which melt above 1500°C, at temperatures above 1000°C of materials which melt above 1500°C, at temperatures above 1000°C of materials which melt below 1500°C; (3) phase equilibria; and (4) reactions at temperatures above 1000°C. M.G.J.

N66-15448*# North Carolina State Coll., Raleigh. Semiconductor Device Lab.

THEORETICAL AND EXPERIMENTAL STUDIES OF RADIATION-INDUCED DAMAGE TO SEMICONDUCTOR SURFACES AND THE EFFECTS OF THIS DAMAGE ON SEMICONDUCTOR DEVICE PERFORMANCE Semiannual Progress Report No. 3, 1 Mar.–31 Aug. 1965

[1965] 37 p refs

(Grant NsG-588)

(NASA-CR-69380; SDL-3-588-1) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Various aspects of surface recombination and Metal Oxide Semiconductor (MOS) capacitors are reviewed in a comprehensive report of theoretical and experimental studies dealing with radiation damage and its effect on semiconductor device performance. Surface recombination velocity as a function of surface potential is studied for an oxide–silicon surface and its variation with gamma radiation. A new model for surface recombination velocity was developed. Variations in surface recombination velocity for p- and n-type silicon are considered as a function of gamma dosage; and bulk lifetimes are given for samples of both kinds before and after oxidation. M.W.R.

N66-15470# Linde Div., Union Carbide Corp., Indianapolis, Ind. Speedway Labs.

CZOCHRALSKI RUBY Annual Summary Report, 1 May 1963–30 Apr. 1964

H. M. Dess 8 Jul. 1964 82 p refs

(Contract Nonr-4132(00); ARPA Order 306-62; Proj. Defender)

(AD-443460)

The Czochralski technique has been successfully utilized to grow ruby crystals of superior quality. The product crystals normally display high crystallographic perfection as has been demonstrated by X-ray and petrographic studies. Optical quality appears to be primarily a function of the nature of the Cr_2O_3 gradients that can occur, and as these are reduced steady improvement has been noted. Lasing performance, judged solely by threshold, energy output, and beam divergence measurements is now edging past the best of the Verneuil crystals. But, in addition, the greater symmetry of the Czochralski beam pattern gives it a decided advantage. Consideration of all these factors gives rise to the expectation that it may be possible to approach diffraction limited performance more closely in the near future as the growth process is further refined. Author

N66-15498# Northwestern Univ., Evanston, Ill. Materials Research Center.

MATERIALS RESEARCH CENTER SIXTH ANNUAL REPORT, 1 FEBRUARY–30 SEPTEMBER 1965

[1965] 132 p refs

(Contract ARPA SD-67)

Contents: Dissipation of energy due to coupling of thermal and mechanical effect; Syntheses and properties of organometallic compounds; Theory of transport and other properties of metals and plasmas; Effect of interaction of imperfections on the deformation mechanism; Microwave investigation of semiconductors and magnetic materials; Electronic properties of solids; Diffraction studies of materials; Polymer studies; Boundary value problems in the elastic theory of dislocations; Studies of semiconducting properties of gray tin; Precipitation studies in solids; Properties of high temperature materials; Thin films and superconductors; Cross linking, chain conformation, and crystallization studies in high polymers; Structure and phase transformations; Ultra thin metal crystals; Theoretical studies of proton transfer mechanisms in hydrogen-bounded solids; Proton relaxation time in polymers; Ultra thin metal crystals; Theoretical studies of proton transfer mechanisms in hydrogen-bonded solids; Proton relaxation time in polymers; Structural studies by diffraction methods; Sintering kinetics; Anisotropic semiconductors; Studies of the defect solid state; Band structure of semiconductors and theory of superfluids; Experimental determination of Fermi surfaces; Direct observation of lattice imperfections and their relation to mechanical and physical properties; Mathematical theory of dislocations, plasticity, viscoelasticity and fracture; Ionization potentials of inorganic molecules by photoionization; Fluorescent lifetimes of large molecules; Solid state nuclear resonance studies; Synthesis and structures of inorganic compounds. TAB

N66-15550# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.

QUENCHED-IN DEFECTS IN P-TYPE SILICON

George Bemski and Carlos Alberto Dias 1964 19 p refs *Its* Notas de Fisica, Vol. XI, No. 7

CFSTI: HC $1.00/MF $0.50

P-type silicon crystals quenched from temperatures between 870°K–1070°K show an increase in donor concentration which disappears on room temperature annealing. This annealing is complete in thin samples and in crystals of relatively low acceptor concentrations. From studies of changes in resistivity on quenching, and the annealing kinetics, we arrive at the following characterization of the defect which resulted from quenching: (1) it is a donor, with a corresponding energy level at about 0.4 ev from Valence band; and (2) its activation energy for motion is about 0.3 ev and its diffusion coefficient at room temperature is 1.2×10^{-7} cm^2/sec. The center ceases to be electrically active on reaching the surface of the samples. A fraction is lost during annealing in thicker samples probably because of formation of pairs with the original acceptor of the crystal. Arguments are presented pointing to the possibility that the defects discussed here are interstitial ions of silicon. Author

N66-15561# Naval Research Lab., Washington, D. C.

PREPARATION AND CHARACTERIZATION OF ULTRAPURE SOLIDS Annual Report, 1 Jul. 1964–30 Jun. 1965

James H. Schulman, G. T. Rado, M. R. Achter, and A. I. Schindler Aug. 1965 115 p refs

(ARPA Order 418)

(NRL-Memo-1640; AD-622369) CFSTI: HC $4.00/MF $0.75

CONTENTS:

1. ALKALI HALIDE CRYSTALS M. Krulfeld p 1–26 refs (See N66-15562 06-26)

2. REFRACTORY METAL CRYSTALS M. R. Achter et al p 27–46 ref (See N66-15563 06-26)

3. TRANSITION METAL AND INTERMETALLIC COMPOUND SINGLE CRYSTALS A. I. Schindler et al p 47–83 refs (See N66-15564 06-26)

4. MAGNETIC MATERIALS G. T. Rado p 85–90 (See N66-15565 06-26)

5. ELECTRON SPIN RESONANCE SPECTRUM OF Mn^{2+} IN β-Ga_2O_3 V. J. Folen p 93–108 refs (See N66-15566 06-26)

N66-15562 Naval Research Lab., Washington, D. C.
ALKALI HALIDE CRYSTALS
M. Krulfeld *In its* Prepn. and Characterization of Ultra-Pure Solids Aug. 1965 p 1–26 refs (See N66-15561 06-26) CFSTI: HC $4.00/MF $0.75

As part of a program to prepare and study highly perfect specimens of refractory metals in which the only structural feature is a grain boundary of controlled misorientation, techniques were developed for the production of highly perfect single crystals and for joining them to make bicrystals. Procedures were developed for the growth of niobium single crystals of high perfection by the strain-anneal technique and for the study of their structure by X-ray and metallographic methods. Measurements were made of the rate of sintering of porosity in the grain boundaries of niobium bicrystals. Bicrystals were prepared for the study of the interfacial energy as a function of misorientation. Techniques were developed for the measurement of intergranular diffusion in the bicrystals of niobium. R.N.A.

N66-15563 Naval Research Lab., Washington, D. C.
REFRACTORY METAL CRYSTALS
M. R. Achter et al *In its* Prepn. and Characterization of Ultra-Pure Solids Aug. 1965 p 27–46 ref (See N66-15561 06-26) CFSTI: HC $4.00/MF $0.75

Research was conducted on the prepartion of ultra-pure alkali halide single crystals suitable for solid state research and involved three interrelated steps: purification, single crystal growth, and characterization and analysis. Both physical and chemical purification methods were used and Kyropoulos techniques and zone refining were studied for single crystal production. Characterization and analysis work included ionic conductivity measurements, emission spectrography, atomic absorption and flame emission spectrophotometry, and solid state spark source mass spectrography. Since experience with solid state mass spectrometry has emphasized the seriousness of cross-contamination which can result when the same apparatus is used for the processing or analysis of different alkali halides, efforts are being concentrated exclusively on KBr. Results obtained in the purification, crystal growth, and analysis of KBr and other alkali halides are presented and some proposed lines of further investigation are discussed. R.N.A.

N66-15564 Naval Research Lab., Washington, D. C.
TRANSITION METAL AND INTERMETALLIC COMPOUND SINGLE CRYSTALS
A. I. Schindler et al *In its* Prepn. and Characterization of Ultra-Pure Solids Aug. 1965 p 47–83 refs (See N66-15561 06-26) CFSTI: HC $4.00/MF $0.75

Studies were conducted on transition metal and intermetallic compounds single crystals and were concentrated on crystal growth kinetics which included the effects of an electric current on the solidification of metals, dendrite tip temperature measurements, and transformation rates during dendritic solidification; growth and perfection of hafnium, ruthernium, and copper single crystals; purity determination for ferromagnetic metals; and impurity distributions in single crystals using resistivity ratio measurements. These efforts constitute a broad approach toward growing and evaluating transition metal and intermetallic compound single crystals in states of extreme purity and perfection, and toward formulating and verifying improvements to current theories governing such crystal formation. Significant achievements in these areas are discussed in detail. R.N.A.

N66-15565 Naval Research Lab., Washington, D. C.
MAGNETIC MATERIALS
G. T. Rado *In its* Prepn. and Characterization of Ultra-pure Solids Aug. 1965 p 85–90 (See N66-15561 06-26) CFSTI: HC $4.00/MF $0.75

Work on the preparation and characterization of magnetic materials was primarily directed toward the improvement of the quality and size of flux grown $Ga_{2-x}Fe_xO_3$ single crystals and toward the characterization of flux grown Al_2O_3 and Ga_2O_3 single crystals by electron spin resonance (ESR) and electron-nuclear double resonance (ENDOR) techniques. A considerable improvements was obtained in the size of $Ga_{2-x}Fe_xO_3$ single crystals. The high quality of the Al_2O_3 and Ga_2O_3 single crystal was confirmed by the practicality of successful ENDOR and applied electric field ESR measurements on Al_2O_3 and forbidden hyperfine ESR measurements on Ga_2O_3. R.N.A.

N66-15566 Naval Research Lab., Washington, D. C.
ELECTRON SPIN RESONANCE OF Mn^{2+} IN β-Ga_2O_3
V. V. Folen *In its* Prepn. and Characterization of Ultra-Pure Solids Aug. 1965 p 93–108 refs Submitted for Publication (See N66-15561 06-26) CFSTI: HC $4.00/MF $0.75

The electron spin resonance spectrum of Mn^{2+} has been investigated in monoclinic β-Ga_2O_3 at 24 kMc/sec. It was found that the spectrum consists of a set of lines corresponding to a single type of environment. This spectrum (including the fine and $\Delta m=0$ hyperfine structure) is satisfactorily described by the spin Hamiltonian for Mn^{2+} in a rhombic crystal field with the following derived constants: $A_z=-87.7\pm0.2$ gauss; $A_y=-85.6\pm0.2$ gauss; $g_z=2.002$; $g_y=2.007$; $D=545.0$ gauss; $E=124.3$ gauss. The y crystal field axis is along the monoclinic axis (b) and the z crystal field axis makes an angle of 18° with the c crystal axis (a>c). Forbidden $\Delta m=\pm1$, ±2 hyperfine transitions were also observed. From the separations between the $\Delta m=\pm1$ doublets, a value of $Q'=+0.9\pm0.2$ gauss was obtained. On the basis of the axial crystal fields inferred from the measured values of Q' in β-Ga_2O_3 and in other oxide materials, it appears that the calculated crystal field contribution to the D parameter of Mn^{2+} does not explain the experimental results. Author

N66-15600*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON COLD CATHODES First Quarterly Report, 14 May–14 Aug. 1965
D. V. Geppert Aug. 1965 99 p refs
(Contract NAS5-9581)
(NASA-CR-69441) CFSTI: HC $3.00/MF $0.75 CSCL 20L

The requirements for the surface film, for the semiconductor, and for the vacuum are presented in detail. Gallium phosphide crystals were intensively studied for application to

the surface-barrier cold cathode. Hall measurements and optical transmission measurements were made and the results analyzed for two large high-quality crystals obtained from two different sources. Lapping, polishing, and etching studies were conducted on these crystals to determine optimum surface preparation procedures. It was found that ohmic contacts to GaP can be produced by alloying lead (Pb) or Te-doped Ag to the crystal surface. It was also found that evaporated Pt forms a blocking contact with a high barrier (~1.45 ev) to GaP. Long life was demonstrated for GaP-Pt diodes and for Ag-BaO phototubes. The GaP-Pt diodes are undergoing dynamic operational life tests and have not changed significantly after 1000 hours. The Ag-BaO photosurface is unchanged after nine months. Author

N66-15609# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1 JANUARY–30 APRIL 1965
Harry C. Gatos 22 Sep. 1965 109 p refs
(Contract AF 19(628)-500)
(EDS-TDR-65-71; AD-622446)

This report covers in detail the solid state research work at Lincoln Laboratory for the period 1 January 1965 through 30 April 1965. The topics covered are Solid State Device Research, Laser Research, Materials Research, and Solid State Physics. TAB

N66-15701# American Optical Co., Southbridge, Mass. Research Div.
EXCITED STATE SATURABLE ABSORBER FOR 1.06 MICRON WAVELENGTH Final Report, 4 Aug. 1964–6 Jul. 1965
Charles C. Robinson Griffiss AFB, N. Y., RADC, Nov. 1965 66 p refs
(Contract AF 30(602)-3470)
(RADC-TR-65-369; AD-624361) CFSTI: HC $3.00/MF $0.75

The excited state absorption of a group of twenty glasses that were singly doped with fluorescent ions was investigated as a function of wavelength. Three ions UO_2^{2+}, Cu^{+}, and Er^{3+} showed a strong effect and these ions were studied more extensively. Energy transfer between Nd^{3+}, Yb^{3+}, and Er^{3+} was shown to increase the excited state absorption in Er^{3+}. Excited state saturable absorption was not observed for the 1.16 micron wavelength in either the UO_2^{2+} or the Cu^{+}, glass. These last experiments were not extensive enough to be conclusive. Author (TAB)

N66-15765# Stanford Univ., Calif. Microwave Lab.
MICROWAVE RESEARCH Quarterly Status Report, No. 26, 1 May–31 Jul. 1965
M. Chodoron et al Sep. 1965 19 p refs
(Contract Nonr-225(48))
(ML-1372; AD-624567) CFSTI: HC $1.00/MF $0.50

Reports are presented for studies related to the microwave region of acoustic wave amplification in piezoelectric semiconductors. These studies are reported under eight projects, which deal with acoustic wave amplification, optical masers, tubable lasers, electron-phonon interactions, geometrical optics of acoustic waves, oscillations in semiconductors, solid state plasma, and differentiation of light by transverse hypersonic waves. M.W.R.

N66-15790*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
THE ERECTED DIPOLE MODEL IN THE ADSORPTION OF CESIUM ON FLUORINATED MOLYBDENUM
Leonard K. Tower Washington, NASA, Feb. 1966 30 p refs
(NASA-TN-D-3223) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Interest in power-producing thermionic diodes containing both electropositive and electronegative additives has led to studies of the structure of adsorbed layers. One of the models advanced to describe this layer is that of the erected dipole, in which polar molecules are erected on a surface by a strong surface electric field. Published evidence for this structure in the case of some adsorbates, namely, barium oxide and cesium chloride, is reviewed. A modified version of the erected dipole model, presented in this report, was used to analyze published data for the system cesium on fluorinated molybdenum. The results are compared with data in the literature and suggest that cesium fluoride molecules are adsorbed as erected dipoles in this system. The effect of this configuration on work function for the system cesium on fluorinated molybdenum as temperature is raised is discussed. Also discussed is the strength of the electric field associated with the surface, which is responsible for the erection of the dipoles. Author

N66-15811*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
RADIATION EFFECTS ON SILICON Final Report, Jun. 1, 1964–May 31, 1965
V. A. J. van Lint and D. P. Snowden 21 Jul. 1965 71 p refs
(Contract NAS7-289)
(NASA-CR-69568; GA-6556) CFSTI: HC $3.00/MF $0.75 CSCL 20L

Defects produced in silicon solar cells exposed to 30-MeV and to ~1 MeV electrons were studied. The rates at which recombination centers were introduced in silicon samples irradiated at room temperature were measured by their spin-resonance responses, and the energy dependence of the divacancy introduction rate in p-type material, and of the vacancy phosphorus pair in n-type FZ silicon was determined. The dominant recombination center in 10 ohm-cm, boron-doped p-type silicon irradiated by 30 MeV electrons was a net donor with an ionization energy greater than 0.4 eV; the recombination center under the same conditions for a 10 ohm-cm, phosphorus-doped n-type silicon was a net acceptor with an ionization energy greater than 0.41 eV. Microwave measurements yielded reliable values of the low-injection lifetime at all temperatures. Introduction rate of centers measured by spin resonance were much smaller than those which dominated the recombination behavior. G.G.

N66-15863# Linde Co., Indianapolis, Ind. Speedway Labs.
YAG CRYSTALS First Quarterly Report, 1 Jun.–31 Aug. 1965
Howard M. Dess [1965] 21 p
(Contract DA-28-043-AMC-01373(E))
(Rept.-1; AD-624596) CFSTI: HC $1.00/MF $0.50

A total of twelve yttrium aluminum garnet crystals have been grown and delivered in accordance with the schedule outlined in the contract. These crystals are representative of the quality achievable with the presently utilized growth procedure. Furthermore, they are meant to provide a base line for comparison with crystals to be produced in the near future via improved techniques. Evaluation test results revealed that all of the crystals possessed a central core region regardless of growth orientation or Nd-dopant level. The size and shape of the core are the major determinants of quality in the as-grown crystals. The <111> growth direction was found to give the tightest core and therefore the highest optical quality crystals. Author (TAB)

N66-15868# Fraunhofer Instituti Freiburg (West Germany).
LIGHT REFRACTION BY TRANSVERSE SUPERSONIC WAVES IN CRYSTALS [DIE LICHTBEUGUNG AN TRANSVERSALEN ULTRASCHALLWELLEN IN KRISTALLEN]
H. Küppers Apr. 1965 19 p refs In GERMAN
(Rept.-2/65) CFSTI: HC $1.00/MF $0.50

The excitation and attenuation of ultrasonic waves in quartz crystals was analyzed. Maximum attenuation of the reflected light waves was found for the case where the ultrasonic wave forms an angle of 45° with the coordinates of the indicatrix. The photoelastic effect disappears when the angle diminished to 0°. Optical isotropic cubic crystals do not show this weakening effect. Transl. by G.G.

N66-15907# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
NEUTRON DIFFRACTION STUDY OF ANTIFERROMAGNETISM IN UO_2
B. T. M. Willis and R. I. Taylor Jul. 1965 14 p refs
(AERE-R-4999) HMSO 2s 6d

Antiferromagnetism in UO_2 was investigated by single-crystal neutron diffraction at liquid-helium temperature. The main conclusions are as follows: (1) The magnetic form-factor curve for the uranium atoms in UO_2 indicates that the unpaired electron configuration has predominantly 5f character. (2) The magnetic ordering is such that the uranium atoms are coupled ferromagnetically within the (200) sheets and antiferromagnetically between sheets. The spin vectors lie within the (200) sheets. (3) The temperature of the antiferromagnetic-paramagnetic transition is 30.6°K. The transition itself is very sharp, with more than half the magnetic intensity disappearing in the last degree before the transition temperature. (4) The effective moment of the uranium atom (U^{4+} ion) is 1.82 Bohr magnetons. Author

N66-15959*# Martin Co., Baltimore, Md. Research Inst. for Advanced Studies.
SOLID STATE STUDIES IN CERAMIC ALLOYS Quarterly Progress Report No. 1, 31 Aug.–30 Nov. 1965
John D. Venables [1965] 7 p refs
(Contract NASw-1290)
(NASA-CR-69622) CFSTI: HC $1.00/MF $0.50 CSCL 20L

A transmission electron microscope study was made of the interaction between dislocations in TiC and trace quantities of boron. TiC single crystals were heated to 2000°C in the presence of small amounts of boron such that the resulting boron concentration in the samples was about 100 ppm. Findings indicated that trace amounts of boron can drastically alter the defect structure of TiC. E.E.B.

N66-15968# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ABSORPTION EDGE SPECTRUM OF SCANDIUM OXIDE
H. H. Tippins Oct. 1965 16 p refs
(Contract AF 04(695)-669)
(TDR-669(9230-02)-4; SSD-TR-65-156; AD-624534) CFSTI: HC $1.00/MF $0.50

The ultraviolet absorption spectrum of single crystals of nominally pure Sc_2O_3 was measured at room temperature and at liquid nitrogen temperature. The results are compared with the probable energy level structure of the system. An estimate of the expected position of the absorption threshold based on simple charge transfer model gives reasonable agreement with the observed absorption edge. Author (TAB)

N66-15982*# Philco Corp., Lansdale, Pa.
DESIGN, DEVELOPMENT, FABRICATION, AND DELIVERY OF IMPROVED MOS TRANSISTORS Second Quarterly Progress Report, 22 Aug.–21 Nov. 1965
Earl S. Schlegel [1965] 88 p refs
(Contract NAS8-11926)
(NASA-CR-69652; R-505) CFSTI: HC $3.00/MF $0.75 CSCL 20L

Detailed models relevant to the chief problem areas have been developed that provide a useful basis for setting up experiments to test the models and add to their known details. The effects of radiation on MOS devices have been evaluated. A useful model has been developed that provides the basis for explaining most of the observed effects of radiation. A variety of oxide types were tested to determine their sensitivity to radiation. There was not much difference among oxides of various types insofar as radiation resistance is concerned. Based on the information developed to date, it is believed that the effects of water on the mobile charge density, fixed charge density and radiation sensitivity are of sufficient magnitude that a major effort is being made to introduce equipment and techniques to the program that will control the water content. Author

N66-15985*# Massachusetts Inst. of Tech., Cambridge.
THE EFFECTS OF IRRADIATION WITH PROTONS ON THE ELECTRICAL PROPERTIES AND DEFECT CONFIGURATIONS OF THE COMPOUND Bi_2Te_3
Praveen Chaudhari (Ph.D. Thesis) 1965 111 p refs
(Grant NsG-496)
(NASA-CR-69666) CFSTI: HC $4.00/MF $0.75 CSCL 20L

Single crystals of p-type Bi_2Te_3 were irradiated at room temperature with 7.5 Mev protons. The Hall coefficient and resistivity were measured as functions of temperature from 82°K to room temperature after successive irradiations. The change in the magneto-resistance coefficient on irradiation was measured at 82°K. Foils of the compound Bi_2Te_3 were irradiated at two levels of flux and examined by transmission electron microscopy. The Hall coefficient of irradiated specimens measured at 82°K increased exponentially with increasing integrated dose. The net effect of irradiation was to introduce donors, which were fully ionized at 82°K. The value of the Fermi level decreased with increasing irradiation dosage. The resistivity of the specimens increased with irradiation. The exponent of the temperature coefficient of the resistivity decreased and became negative after irradiation with a dose of 1.2×10^{16} protons per cm^2. The magneto-resistance coefficient measured at 82°K decreased with increasing irradiation and appeared to reach saturation after a dose of 1.0×10^{16} protons per cm^2. The band structure parameters calculated from the measured values of the Hall coefficient, resistivity, and magneto-resistance changed rapidly after doses of 1.0×10^{16} protons per cm^2. Author

N66-16009# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seibersdorf (Austria). Reactorzentrum.
INVESTIGATION OF THE ELECTROLYTIC DISCHARGE OF URANIUM ON METAL [UNTERSUCHUNGEN UBER DIE ELEKTROLYTISCHE URANABSCHEIDUNG AUF METALLEN]
V. Pfeifer and H. Bildstein 1965 15 p ref In GERMAN Submitted for Publication
(SGAE-CH-16/1965) CFSTI: HC $1.00/MF $0.50

The utilization of ammonium fluoride as electrolytic bath in the electrochemical deposition of thin uranium layers onto steel, aluminum, and other metals was studied as a function of

electrolyte concentration and acidity as well as for its time dependency. Application of a rotating anode during the electrolytic process reduced the required deposition time. Uranium depositions obtained by this method resulted in thin films of 1 mg U/cm^2 on 6 cm^2 metal substrates. Transl. by G.G.

N66-16083*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SOLAR-RADIATION-INDUCED DAMAGE TO OPTICAL PROPERTIES OF ZnO-TYPE PIGMENTS Technical Summary Report, 24 Jun. 1964–27 Jun. 1965
Sep. 1965 171 p refs
(Contract NAS8-11266)
(NASA-CR-69713; LMSC-M-50-65-2) CFSTI: HC $5.00/MF $1.00 CSCL 20L

Identification studies on the primary mechanism involved in solar radiation induced damage to the optical properties of zinc oxide semiconductor pigments are reported. Carefully prepared particulate samples of zinc oxide were exposed to radiation of wavelengths between 1.2 and 2.6μ and the bidirectional spectral reflectance of the samples was monitored *in situ*. Static ultraviolet tests before and after exposure measurements were also carried out, and a number of single zinc oxide crystals were irradiated to establish the relative importance of surface and bulk damage processes. Initial reflectance spectra of particulate samples in a vacuum were reduced by solar radiation but recovered upon sample exposure to air. Visible damage of the samples was enhanced at elevated temperatures, while the infrared damage remained relatively insensitive to temperature. A working model for solar radiation induced damage to the optical properties of zinc oxide was formulated and a band structure for zinc oxide was derived by the method of corresponding states. G.G.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N66-15532# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
REPORT OF THE MEETING OF THE PROPELLANT RESEARCH BOARD ON 3 DECEMBER 1964 IN TRAUEN/SOLTAU [BERICHT UBER DIE SITZUNG DES FORSCHUNGSAUSSCHUSSES TREIBSTOFFE AM 3. DEZEMBER 1964 IN TRAUEN/SOLTAU]
A. Dadieu 1 Oct. 1965 76 p refs In GERMAN
(DLR-65-10) CFSTI: HC $3.00/MF $0.75

The following topics were discussed: (1) *Lithergolic Propellants*—basic problems, and future developments and application possibilities; (2) *Combustion in Lithergol Rocket Engine*—experiments with nitric acid as oxidizer; (3) *Hypergolization of Solid Fuels by Nitric Acid, respectively, Dinitrate Tetroxide in Nitric Acid*; and (4) *Lithergolic Combustion Reactions of Lithium Hydride with Fluorite*. Transl. by G.G.

N66-15702# Atlantic Research Corp., Alexandria, Va. Kinetics and Combustion Group.
RESEARCH ON THE DEFLAGRATION OF HIGH-ENERGY SOLID OXIDIZERS Quarterly Technical Summary Report No. 13, Jan. 1–Aug. 31, 1965
J. B. Levy and G. von Elbe 11 Oct. 1965 13 p refs
(Contract AF 49(638)-1169)
(AD-624533) CFSTI: HC $5.00/MF $0.50

The flame temperature of hydrazine diperchlorate was measured using fine Chromel-Alumel thermocouples. At 28 atm the measured temperature was found to be > 200° C below the calculated product gas temperature. The observed temperature increased with pressure, and at approximately 100 atm the theoretical value is attained. The temperature profile through the preheat zone of the combustion wave was carefully measured at 18 atm. This was found to agree well with that predicted by theory if some variation of thermal diffusivity with temperature is assumed. The thermal profile at low pressure was found not to exhibit the character of that of a normal deflagration wave. This finding has shed considerable light on the nature of the process. Finally, quenching experiments were performed and these are discussed.
Author (TAB)

N66-15740# National Aerospace Lab., Tokyo (Japan).
FLAME PROPAGATION INTO THE GAP OF SOLID PROPELLANT GRAIN (I)
Tomifumi Godai 1965 18 p refs In JAPANESE; ENGLISH summary
(NAL-TR-91) CFSTI: HC $1.00/MF $0.50

The flame propagation into a narrow gap, which is prepared perpendicular to the prime burning surface of solid propellant grain, has been experimentally investigated using the test specimens of polyester–ammonium perchlorate composite propellants. Experimental results show that the flame propagates from the original burning surface into a gap when its width is larger than some critical value and vice versa. This means that there always exists the critical value for the width of gap which is the threshold of propagation and nonpropagation of flame into it. The critical value is primarily the function of linear burning rate and the overall mechanism of flame propagation into a gap of solid propellant grain will be explained with the quenching theorem. Author

N66-15763# Frankford Arsenal, Philadelphia, Pa. Pittman-Dunn Research Labs.
A SURVEY OF SOME OF THE RECENT APPLICATIONS OF PYROTECHNICS TO SMALL ARMS AMMUNITION AND MILD DETONATING FUSE SYSTEMS
Winston W. Cavell [1965] 34 p refs Presented at the Am. Ordnance Meeting, Monterey, Calif. 4–5 Nov. 1965
(A65-9; AD-624607) CFSTI: HC $2.00/MF $0.50

Mild detonating fuse (MDF) applications to aircraft escape systems are presented. The explosive components for MDF systems are discussed. Explosives and pyrotechnics with high stability temperatures are needed to increase the ability of the explosive components to withstand temperatures encountered on aerodynamic heating or in highly ionized media. Desired properties of explosives are listed, and mechanical and thermochemical approaches in designing reliable nonfragmenting MDF systems, utilizing pyrotechnic delays, are discussed. Other MDF topics discussed include transition from detonation to deflagration, delays, and ignition through metal webs (or through bulkhead ignition) from one hermetically sealed MDF system to another hermetically sealed MDF system which requires the use of pyrotechnic delay mixtures. Terminal boosters and their components are discussed. A new method for the laboratory simulation of gun barrel tracer functioning is presented. Several methods of delivering an impact have been investigated. Statistical analysis similar to that used for evaluating impact sensitivity of percussion primers has been applied

to evaluate sensitivity results. Preliminary correlation has been established between gun firing data and impact sensitivity. A tracer mixture with high visibility and a new method of tracer projectile charging are presented. Author (TAB)

N66-16000# Atlantic Research Corp., Alexandria, Va. Kinetics and Combustion Div.
RESEARCH ON THE DEFLAGRATION OF HIGH-ENERGY SOLID OXIDIZERS Quarterly Technical Summary Report, 1 Dec. 1963–29 Feb. 1964
R. Friedman and J. B. Levy 6 Jul. 1964 31 p refs (Declassified)
(Contract AF 49(638)-1169; ARPA Order 332-62)
(Rept.-7; AD-351940)

Measurements of vaporization rates, deflagration rates, temperature profiles in the deflagrating strands, and flame temperatures are presented for hydrazine perchlorate. Except in the presence of small amounts of fuel or catalyst additive, the deflagration of pure hydrazine perchlorate is erractic and nonreproducible. Reproducibility is attainable only between 1/4 and 7 atms. It is concluded that at higher pressures the liquid layer becomes too thin to support the contribution of the condensed-phase reaction necessary for stable deflagration. Preparation and processing of the hydrazine perchlorate are discussed along with strand preparation and sublimation experiments. M.W.R.

N66-16014# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Stuttgart (West Germany). Institut fuer Raketentreibstoffe.
SOME PROPERTIES OF LITHIUMHYDRIDE WITH RESPECT TO ITS USE AS A ROCKET FUEL. PART I: THE DENSITY OF LiH FUEL GRAINS MADE BY COMPRESSION OF LiH POWDER [EINIGE EIGENSCHAFTEN VON LITHIUMHYDRID IM HINBLICK AUF SEINE VERWENDUNG ALS RAKETENBRENNSTOFF. I TEIL: DICHTE VON LiH-PRESSKOERPERN]
Roger E. Lo Nov. 1965 24 p refs In GERMAN; ENGLISH summary
(DLR-FB-65-49; DVL-444) CFSTI: HC $1.00/MF $0.50

The production of LiH fuel grains for combustion in hybride rocket motors is described. An empiric formula is derived for calculating the density which is to be expected at various pressures of formation for LiH fuel grains of given mass and cross section. Author

N66-16155*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EFFECTS OF VARIOUS ADDITIVES ON PHYSICAL PROPERTIES AND PERFORMANCE OF MONOMETHYLHYDRAZINE
Harold Perkins 3 Nov. 1965 18 p refs
(NASA-TM-X-53356) CFSTI: HC $1.00/MF $0.50 CSCL 21I

The freezing and boiling points of 0–40% mixtures of various nitrogen compounds and water in monomethylhydrazine (MMH) were determined experimentally. The additives for these mixtures were selected on the basis of chemical similarity to MMH, mixture thermal stability, probability of contamination occurrence, cryoscopic and ebullioscopic effects, and anticipated effects on propellant performance. Theoretical specific impulses were calculated as a function of additive concentration using nominal values of the Saturn S-IVB Vehicle Auxiliary Propulsion System motor as a basis. Based on the results of these studies, N,N-dimethylformamide and water appear to be the most suitable additive for increasing the liquid range of MMH without degrading its performance. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N66-15274# Naval Missile Center, Point Mugu, Calif.
PRELIMINARY ANALYSIS AND EXPLORATORY TESTING OF AN INJECTION-INDUCTION ENGINE
L. E. Spoerlein 6 Aug. 1965 37 p refs
(NMC-TM-65-44; AD-619733) CFSTI: HC $2.00/MF $0.50

The injection-induction air-breathing engine is a constant burning, air-breathing jet engine that produces static thrust with no moving parts. This program was conducted to gain preliminary insight into the feasibility of this type of engine and consisted of literature searches, theoretical analyses, operating cycle and component size calculations, as well as the fabrication and testing of a test engine. Except to yield information on performance characteristics of some components of the engine when used in other applications, the literature searches produced no evidence of any research or development of an engine of this type. The theoretical analyses showed that the performance of an injection-induction engine could be expressed by a relatively simple mathematical relationship. An operating cycle calculation and component size calculations indicated that the performance and size of this type of engine would compare favorably with these characteristics for currently used air-breathing jet engines. The results of exploratory tests of the injection-induction engine indicated that an engine of this type was feasible. Author (TAB)

N66-15295*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ROCKET MOTOR SPIN DATA
Melvin H. Lucy, G. Burton Northam, and Robert L. Swain [1964] 67 p refs Presented at the Naval Ordnance Sta. Symp. on Behavior of Propellants under Acceleration Fields, China Lake, Calif. 18–19 Nov. 1964
(NASA-TM-X-56052) CFSTI: HC $3.00/MF $0.75 CSCL 21H

This paper describes tests on rockets ranging in weight from 100 to 2800 pounds, diameters to 30 inches, and lengths to 147 inches at roll rates from 100 to 900 rpm under both sea-level and simulated altitude conditions. Details presented on each solid rocket tested include a description of the rocket motor with propellant composition and configuration, the test environment, and the test results. Results indicate a high degree of ballistic sensitivity with severe thermal rocket degradation in some types of motors tested ranging down to essentially no effect in other types of units tested. Free-flight results are presented where available. The data presented herein were principally obtained from the spin qualification of motors for flight and is not a systematic study of the parameters involved. Author

N66-15320*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A CRITICAL DISCUSSION ON THE PLANNING CONSIDERATIONS OF ELECTRIC PROPULSION FOR SPACE MISSIONS
John W. Stearns [1964] 32 p refs Presented at the AIAA 3d Bien. Aerospace Power Systems Conf., Philadelphia, 1–4 Sep. 1964
(NASA-CR-60750) CFSTI: HC $2.00/MF $0.50 CSCL 21C

A discussion of a paper by B. Pinkel was requested and is given here. It is to be noted that consideration of electric propulsion development cannot be taken out of the context of the development of the entire field of advanced propulsion. This discussion therefore provides a comparison of the present major technology programs in advanced propulsion on the basis both of technological state-of-the-art and of missions capability. Some additional features concerning the economic problems of deep space exploration are provided which may seriously limit the application of any form of advanced propulsion to unmanned exploration. For manned planetary exploration, it is entirely possible that a combined system utilizing both nuclear and electric propulsion systems is more reasonable than either propulsion system alone. Author

N66-15337*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

AN EXPERIMENTAL CORRELATION OF THE NONREACTIVE PROPERTIES OF INJECTION SCHEMES AND COMBUSTION EFFECTS IN A LIQUID-PROPELLANT ROCKET ENGINE. PART VI: THE RELATION BETWEEN THE STARTING TRANSIENT AND INJECTION HYDRAULICS

Richard M. Clayton and Jack H. Rupe 29 Oct. 1965 29 p refs (NAS7-100)

(NASA-CR-69251; JPL-TR-32-255) CFSTI: HC $2.00/MF $0.50 CSCL 21H

Starting flow transient criteria for gas-pressurized liquid bipropellant rocket engines are presented. These criteria are based on a consideration of the hydraulic characteristics of the propellant feed system, with particular emphasis on the propellant valve, the injector, and the injector-manifold volume. The desirability of a short starting transient without chamber pressure overshoot is presumed. A nonreactive testing technique is presented for the evaluation of the starting flow transient prior to the commitment of an engine to its initial firing. Results of the application of both the flow criteria and the nonreactive testing technique in an injection research program utilizing a 20 000 lb thrust rocket motor are also presented. Author

N66-15360*# Boeing Co., Renton, Wash.

EXHAUST JET WAKE AND THRUST CHARACTERISTICS OF SEVERAL NOZZLES DESIGNED FOR VTOL DOWNWASH SUPPRESSION. TESTS IN AND OUT OF GROUND EFFECT WITH 70°F AND 1200°F NOZZLE DISCHARGE TEMPERATURES

C. C. Higgins, D. P. Kelly, and T. W. Wainwright Washington, NASA, Jan. 1966 99 p refs

(Contract NASw-908)

(NASA-CR-373) CFSTI: HC $3.00/MF $0.75 CSCL 21E

Jet wake degradation and thrust characteristics of eleven exhaust nozzle models designed for dynamic pressure and temperature reduction in the jet were evaluated statically using hot gases and unheated air. Similar tests were conducted with a reference circular nozzle. Additional tests of selected nozzles were conducted to determine effects of fuselage and/or proximity of a ground plane on thrust and jet wake characteristics. Results show jet wake degradation for all suppressor nozzles in and out of ground effect and with various fuselage configurations. Most rapid jet wake degradation was achieved with nozzle designs having widely spaced and/or high aspect ratio nozzle elements. Except for regions very close to the nozzle exit, increasing exit wall divergence angles provided only a small improvement in jet wake degradation characteristics. Thrust losses were a function of nozzle geometry with losses minimized for nozzles with small exit wall divergence angles and moderate values of aspect ratio of the discharge openings. Nozzle–fuselage combinations resulted in additional thrust losses which were further increased when operating in proximity with a ground surface. Fuselage ventilation also reduced thrust losses, particulary with suppressor nozzles. R.N.A.

N66-15408# Pratt and Whitney Aircraft, East Hartford, Conn.

RESEARCH AND DEVELOPMENT OF TITANIUM ROCKET MOTOR CASE Eighteenth Quarterly Report, Apr. 1–Jun. 30, 1965

R. J. Makowski and H. H. Hauser 31 Jul. 1965 25 p

(Contract DA-19-020-ORD-5230)

(WAL-766.2/1-20; AD-623143) CFSTI: HC $1.00/MF $0.50

The results of work performed during the quarter April 1 through June 30, 1965 are reported. Included are discussions of the attempts to flow-turn the last two blanks and an analysis of material from flowturn blank serial number 2 after failure during sizing. Author (TAB)

N66-15488*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL DATA ON PUMPING OF MERCURY ION BEAMS BY LIQUID-NITROGEN-COOLED CONDESNERS

Edward A. Maslowski Washington, NASA, Jan. 1966 15 p refs (NASA-TN-D-3231) CFSTI: HC $1.00/MF $0.50 CSCL 21C

A program was conducted to evaluate the performance of liquid-nitrogen-cooled condensers in pumping the exhaust of mercury ion thrustors. Tests were conducted with two different condensers. One of the condensers was a smooth cylinder having a total surface area of 3.8 square meters, and the other condenser was of honeycomb type of construction and had a total surface area of 62.9 square meters. Two targets, having apex angles of 32° and 148°, respectively, were used with each condenser. Ion beam current ranged from 10 to 200 milliamperes and accelerating potential from 2.0 to 6.0 kilovolts. The results were evaluated on the basis of a performance factor F* which is a function of the condenser accommodation and sticking coefficients. A mean value of F* of 0.75 was determined in this study. A visual observation of mercury distribution patterns showed that the ratio of effective pumping area to actual geometric area was 0.4 for the smooth condenser and 0.1 for the honeycomb condenser. This study showed no significant difference in the effect of the two targets. Author

N66-15519# Wissenschaftliche Gesellschaft fur Luft- und Raumfahrt, Cologne (West Germany).

REPORT ON THE MEETING OF THE SCIENTIFIC COMMITTEE ON ROCKET TECHNIQUE AT COLOGNE, 7 FEBRUARY 1965 [BERICHT UBER DIE SITZUNG DES FACHAUSSCHUSSES RAKETENTECHNIK AM 7. FEBRUAR 1965 IN KOLN]

Apr. 1965 99 p refs In GERMAN

(DLR-MITT-65-03) CFSTI: HC $3.00/MF $0.75

The following studies are reported: (1) *Comparative Thermodynamics of Primary and Secondary Rocket Propulsion Units*—fuel injection by pressure, and through pumping; (2) *Application Problems of Primary and Secondary Rocket Propulsion Units*—increased burn up pressure, and mechanics of turbine pump; (3) *Studies of Various Turbine Pump Applications in Rocket Propulsion Units with Maximal Payloads*—thermodynamics of axial flow turbopumps for high energy propellants. Transl. by G.G.

N66-15557# Marine Engineering Lab., Annapolis, Md.

STATE-OF-THE-ART SURVEY ON HOT CORROSION IN MARINE GAS-TURBINE ENGINES

G. J. Danek Mar. 1965 36 p refs
(MEL-32/65; AD-461181)

This summary describes a state-of-the-art survey of hot corrosion problems which can seriously limit the suitability of gas-turbine engines for marine propulsion systems. Catastrophic attack of nickel- and cobalt-base superalloys at temperatures above 1550° F is attributed to the action of a molten slag that forms by the reaction of ingested sea salt and sulfur contained in the fuel. A general lack of agreement was found to exist among investigators on the mechanisms of sulfidation corrosion, methods of sorting and screening materials, resistance of specific materials to attack, and proposed solutions to the problem. Nevertheless, the collected information provided valuable guidance in formulating the Navy's Marine Gas-Turbine Alloy Development Program. A description of this program and specifications selected for standardized equipment to evaluate sulfidation resistance are presented. Author (TAB)

N66-15660# RAND Corp., Santa Monica, Calif.
THE IMPACT OF THE HIGH DEVELOPMENT COST OF ADVANCED FLIGHT PROPULSION SYSTEMS ON DEVELOPMENT POLICY
B. Pinkel Oct. 1965 72 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4560-PR; AD-624856) CFSTI: HC $3.00/MF $0.75

A discussion of techniques for handling R and D funds to reduce the investment risk in implementing programs for new propulsion systems, particularly systems which are novel and advanced. To guide the funding management, relevant R and D activities are described in detail, followed by a discussion of criteria to be met before an engine qualifies for consideration. Author (TAB)

N66-15721# California Univ., Berkeley. Inst. of Engineering Research.
CALCULATION OF ENGINE PERFORMANCE USING AMMONIA FUEL. II: DIESEL CYCLE
Henry K. Newhall Sep. 1965 47 p refs *Its* Tech. Rept.-3
(Contract DA-04-200-AMC-791(X))
(TS-65-3; AD-624565) CFSTI: HC $2.00/MF $0.50

A digital computer program was used to predict theoretical performance for ammonia as a fuel for Diesel engines. The theoretical model employed is the Diesel cycle, and products of combustion were treated as a chemical equilibrium system. Results are presented for ammonia and in addition for cetene, a common hydrocarbon fuel. It is thus possible to directly compare the performance predicted for ammonia to that predicted for commonly employed hydrocarbon fuels. The following conclusions regarding performance of ammonia are based upon this work: (1) In the event of developments leading to successful combustion of ammonia in Diesel engine application, ammonia would be expected to yield up to 10% more power output than typical hydrocarbon fuels operating under the same conditions. (2) The thermal efficiency obtained with ammonia would be expected to be greater than that for hydrocarbon fuels by as much as 20%. (3) Specific fuel consumption for ammonia may be expected to be approximately 2-1/2 times greater for ammonia than for hydrocarbon fuels. (4) The exhaust concentration of nitric oxide resulting from the use of ammonia should be substantially less than that produced by hydrocarbon fuels. Author (TAB)

N66-15755# AeroChem Research Labs., Inc., Princeton, N. J.
RADAR INTERFERENCE EFFECTS IN THE LEM DESCENT ENGINE EXHAUST PLUME Final Report, 5 Feb.–5 Jun. 1965
W. J. Miller and H. S. Pergament Jul. 1965 105 p refs Prepared for Grumann Aircraft Supersedes TL-205; L-210; T-210a; L215
(TP-118; TL-205; TL-210; TL-210a; TL-215; AD-624581) CFSTI: HC $4.00/MF $0.75

An experimental program was undertaken to determine the importance of chemi-ionization as an electron-contributing mechanism in the LEM descent engine propellant system. Studies were conducted on UDMH/N_2O_4 diffusion flames at low pressures (5 to 50 Torr) using Langmuir probes and mass spectrometric procedures. These flames were also examined using Langmuir probes at atmospheric pressure and at the descent engine chamber pressure (110 psia). The actual fuel, Aerozine 50/N_2O_4, was tested at the latter pressure only, under conditions directly analogous to those in the chamber. It was concluded as a result of this experimental investigation that thermal ionization will be, by far, the dominant electron-producing process in the LEM combustion chamber. The refraction and attenuation of two radar beams passing through the LEM exhaust plume are predicted. The maximum beam refraction is predicted to be about 2 milliradians for the doppler beam passing through the most dense part of the plasma. The altimeter beam experiences a maximum refraction of just over 1 milliradian. The attenuation (absorpiton) of both beams was found to be less than 0.1 db, which is probably well within the allowable signal-to-noise margin for the LEM radars. Author (TAB)

N66-15756# Continental Aviation and Engineering Corp., Detroit Mich.
HEAVY-LIFT TIP TURBOJET ROTOR SYSTEM. VOLUME XII: FUEL PUMP AND CONTROL SYSTEM DESIGN
Fort Eustis, Va., Army Aviation Materiel Labs., Oct. 1965 141 p refs Prepared jointly with Chandler Evans Corp. for Hiller Aircraft Corp.
(Contract DA-44-177-AMC-25(T))
(CAE-943; USAAVLABS-TR-64-68; AD-624822) CFSTI: HC $5.00/MF $1.00

The report discusses the proposal of a combination hydromechanical-electronic fuel control and fuel pump for control of a helicopter rotor tip mounted engine (CAE Model 357-1) which during normal operation is subjected to 235g of centrifugal force. The proposed preliminary design is submitted to meet the specification requirement of the engine in the tip torboject hover mode of operation. Analytical design studies and preliminary test results show feasibility of this design for operation in a 235g field. Author (TAB)

N66-15898# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
EXPERIMENTAL INVESTIGATION ON ANNULAR AND THROTTLEABLE PLUG NOZZLES
G. Angelino and E. Sacchi 1964 70 p refs
(VKI-TN-24) CFSTI: HC $3.00/MF $0.75

An investigation was conducted to study the performance of annular plug effusers and throttleable annular plug nozzles. An attempt was made to evaluate the influence of the nozzle configuration on the base drag, with all experiments conducted in the absence of external flow. The validity of the results may be extended to free flight conditions in cases in which the influence of external flow on the propulsion system may be neglected. In performing tests with the throttleable annular plug nozzles, the movable plug of one of the models was shifted in the axial direction, causing a reduction of the nozzle throat area and mass flow. The efficiency of the modified nozzle was measured for various plug axial positions and working

pressure ratios. All the experimental data were obtained by means of pressure measurements and Schlieren flow visualization. Thrust and drag were obtained by numerical integration of the pressure diagrams. C.T.C.

N66-15947# Hiller Aircraft Corp., Palo Alto, Calif.
HEAVY-LIFT TURBOJET ROTOR SYSTEM. VOLUME VII: WEIGHT AND BALANCE STUDIES
Ft. Eustis, Va., Army Aviation Mater. Labs., Oct. 1965 30 p *Its* Rept.-64-47
(Contract DA-44-177-AMC-25(T))
(USAAVLABS-TR-68G; AD-624813) CFSTI: HC $2.00/MF $0.50

The report discusses statistical, analytical, and empirical weight analysis methods used to evaluate the empty weight of the helicopter. Blade lag characteristics are also discussed, including an analysis showing blade lag angles with one and two engines inoperative. Included are aircraft balance predictions. Author (TAB)

N66-15948# Continental Aviation and Engineering Corp., Detroit, Mich.
HEAVY-LIFT TIP TURBOJET ROTOR SYSTEM. VOLUME XI: ENGINE DESIGN
Ft. Eustis, Va., Army Aviation Mater. Labs., Oct. 1965 115 p Prepared for Hiller Aircraft Corp.
(Contract DA-44-177-AMC-25(T))
(CAE-942; USAAVLABS-TR-64-68X; AD-624716) CFSTI: HC $4.00/MF $0.75

The report discusses the design of the model 357-1 engine for rotor tip operational environment. The detail design meets requirements of MIL-E-5007-B except for items peculiar to rotor tip operation. These items include operational attitudes, effect of continuous gyroscopic couples and high G field environment. The report includes an analytical design analysis of the static structure, rotating elements, bearings, accessory drives, lubrication system and miscellaneous engine parts. Author (TAB)

N66-16038*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
PERFORMANCE STUDY OF A REPETITIVELY PULSED TWO-STAGE PLASMA PROPULSION ENGINE Final Report
B. Gorowitz, P. Gloersen, and J. H. Rowe 20 Nov. 1963 113 p refs
(Contract NAS3-2502)
(NASA-CR-55248) CFSTI: HC $4.00/MF $0.75 CSCL 21C

Study of the performance of the repetitively pulsed two-stage coaxial plasma engine is continuing. Data were obtained in the following categories: (1) the operating characteristics of the major components of the existing engine system; (2) performance trends associated with change of design and operating parameters; and (3) correlation of experimental results with those predicted by an analytical model. An accelerator efficiency of 43% was obtained, and no insurmountable problems were indicated. Further optimization of the performance of this engine will depend upon appropriate matching of the electrical circuit characteristics to the geometrical characteristics of the accelerator and the density and distribution of the propellant load. M.P.G.

N66-16073*# Chrysler Corp., Huntsville, Ala. Space Div.
SATURN STAGE S-1-8 FINAL STATIC TEST REPORT
J. K. Crawford 5 Aug. 1964 151 p refs
(Contract NAS8-4016)
(NASA-CR-69702) CFSTI: HC $5.00/MF $1.00 CSCL 21H

Results are given on the acceptance test firings of the Saturn stage S-1-8, conducted to demonstrate the correct functional performance and operation of the airborne systems. Both the short duration and full duration tests were held under simulated flight conditions. Details are also given on the performance of the engine, engine hydraulic, propellant and pneumatic, electrical control, and telemetry systems; the engine compartment environment; and the vibration and special instrumentation. The test requirements were successfully achieved, with the exception of the pretest objective of topping LOX to a flight ullage of 2.2 percent immediately prior to ignition. Problem areas were investigated, and recommendations are made. Systems static test procedures are listed, and values for parameters which were monitored to assure vehicle safety are specified. A test data sheet is included on stage and ground support, along with a compilation of the critical components time/cycle history. The unsatisfactory condition report is summarized, and meteorological data on the SA-21 test are tabulated. M.G.J.

N66-16087*# Bell Aerosystems Co., Buffalo, N. Y.
A STUDY OF PERSONNEL PROPULSION DEVICES FOR USE IN THE VICINITY OF THE MOON, VOLUME I
N. Economou et al Washington, NASA, Jan. 1966 275 p refs
(Contract NAS1-4098)
(NASA-CR-365) CFSTI: HC $6.00/MF $1.50 CSCL 21H

This report presents results of studies to establish conceptual configurations of propulsion devices which can be used for transportation on the moon, and for escape from the surface of the moon and injection into the lunar orbit. The study was directed toward simple devices which make maximum utilization of the perceptual and control abilities of the pilot and minimum automatic flight control and guidance equipment. The scope of the program was to provide design data and vehicle dynamic characteristics in parametric form to permit the NASA, through simulation studies, to evaluate, refine and select an optimum or near optimum configuration for the intended mission. Author

N66-16153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FILL VALVE DEVELOPMENT FOR THE ADVANCED LIQUID PROPULSION SYSTEM (ALPS)
W. F. Mac Glashan, Jr. 1 Feb. 1966 27 p refs
(Contract NAS7-100)
(NASA-CR-69918; JPL-TR-32-875) CFSTI: HC $2.00/MF $0.50 CSCL 21H

A simple, compact, lightweight valve was developed to satisfy the need for reliable fill valves for the Advanced Liquid Propulsion System (ALPS). Manually operated valves for on-off control of Earth-storable propellants and inert gases were designed, built, and tested. The preferred valve design consists of a ceramic ball, a screw, and a tank boss. The screw pushes the ball onto a spherically lapped seat in the tank boss. With the ground fitting engaged, the valve can be actuated irrespective of line pressure. Flow can be either around or through the screw. Several variations of this ball valve are described. Problems encountered, refinements, and test results are discussed. Author

N66-16161*# Cosmic, Inc., Washington, D. C.
FURTHER DEVELOPMENT OF A CHARGED LIQUID COLLOID SOURCE FOR ELECTROSTATIC PROPULSION Final Report

D. Gignoux, H. F. Anton, J. J. Shea, and R. M. Moriarty Oct 1965 74 p refs *Its* Rept.-106
(Contract NAS3-6268)
(NASA-CR-54642) CFSTI: HC $3.00/MF $0.75 CSCL 21C

A beam of charged liquid particles has been proposed for electrostatic thrustors. Experiments accomplished with a spinning nozzle in a vacuum, having its edge submitted to an intense electric field, resulted in operation for several hours with high beam currents and substantial thrust. Several propellants consisting of a solution of a salt in an organic solvent have been selected by a chemical analysis and tried successfully in the system. A performance mapping experiment has been accomplished. An analytical investigation has resulted in a theory which predicts performance parameters as a function of operating parameters. This theory checks a part of the data. It has been determined that further understanding of electrostatic spraying in vacuum will require knowledge of the influence of the residual atmosphere near the edge of the nozzle and in the vacuum chamber. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N66-15242*# California Univ., La Jolla.
GALACTIC X-RAY SOURCES
G. R. Burbidge, R. J. Gould, and W. H. Tucker [1965] 12 p refs Submitted for Publication
(Grant NsG-357)
(NASA-CR-60520) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Of the four possible origins or mechanism for galactic X-ray production, neutron stars and Compton scattering are ruled out. The authors consider it difficult to express a preference for either bremsstrahlung or synchrotron hypotheses. It is emphasized that the energy loss time scales for the high energy synchrotron electrons are very short, while bremsstrahlung X-ray production requires very high temperatures. Although the basic mechanisms are uncertain, it is considered likely that supernova outbursts are the likely origins of X-ray sources. M.W.R.

N66-15345*# California Univ., Berkeley. Space Sciences Lab.
INCREASED BRIGHTNESS OF THE LUNAR SURFACE
A. Palm and J. Koo 15 Jun. 1965 37 p refs *Its* Ser. No. 6, Issue No. 35
(Grant NsG-243-62)
(NASA-CR-69289) CFSTI: HC $2.00/MF $0.50 CSCL 20H

A number of mechanisms have been examined by which the enhanced solar radiation and flare protons could produce increases of the moon's brightness. The most plausible processes include direct luminescence, enhanced reflection in spectral regions characteristic of newly formed color centers, and indirect luminescence due to optical bleaching of these centers. However, the presumed solar energy flux intersecting the moon's orbit is not sufficiently intense for these processes to cause more than a fractional increase. Alternatively, the enhanced local brightness may have a solar origin. As more intense electromagnetic flux gives rise to a higher reflectivity in proportion to the color and intrinsic reflecting power of the surface material, existing color contrasts of the different lunar features become augmented. Author

N66-15352*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.
IMPULSIVE EMISSION OF >40 KeV ELECTRONS FROM THE SUN
J. A. Van Allen and S. M. Krimigis Jun. 1965 51 p refs *Its* Rept.-65-28
(Contract NsG-233)
(NASA-CR-69350) CFSTI: HC $3.00/MF $0.50 CSCL 20H

Using data from a system of three thin-window Geiger tubes and one thin silicon surface barrier detector on the Mars-bound spacecraft Mariner IV, we have observed three interplanetary particle events on May 25–28, June 5–7, and June 13–14, 1965. The particles are identified conclusively as electrons of energy $E_e \geq$ 40 keV with steeply falling energy spectrums and with approximately isotropic angular distributions. The maximum unidirectional intensities are 80, 58, and 5 $(cm^2 \text{ sec sterad})^{-1}$, respectively. The time profiles of intensity exhibit abrupt onsets, increases to maximum values in times of the order of several hours, and gradual declines over periods of the order of a day. It appears that these bursts of interplanetary electrons are emitted impulsively from the sun at approximately the same time as are bursts of radio noise and X-rays observed by others with terrestrial equipment. The interplanetary diffusion of electrons is discussed and it is estimated that about 10^{34} electrons E_e >40 keV were emitted on May 25 and on June 5 and about 10^{33} on June 13. Author

N66-15379*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
THE EFFECT OF ADIABATIC DECELERATION ON THE COSMIC RAY SPECTRUM IN THE SOLAR SYSTEM
E. N. Parker [1965] 30 p refs
(Grant NsG-96-60)
(NASA-CR-69344; EFINS-65-92) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Cosmic rays in the magnetic fields carried in the solar wind are continually expanded and decelerated, in addition to being convected out of the solar system. The effect of the deceleration on the cosmic ray spectrum is calculated for the case that the outward convection of cosmic rays is small and for the case that the cosmic ray spectrum is a simple power law and the diffusion coefficient is independent of energy. The calculations are carried out for both particle momentum and energy. It is shown that a power law spectrum is preserved by the deceleration. It is shown that the deceleration contributes a decrease at high energies of about one third of the total modulation. Where the spectrum flattens out at lower energies, the deceleration produces an increase which partially cancels the reduction by convection. Author

N66-15458*# Chicago Univ., Ill. The Enrico Fermi Inst. for Nuclear Studies.
THE KINETIC PROPERTIES OF THE GALACTIC COSMIC RAY GAS
E. N. Parker [1965] 18 p refs
(Grant NsG-96-60)
(NASA-CR-69378; EFINS-65-103) CFSTI: HC $1.00/MF $0.50

The elementary formulae for the pressure and the speed of sound in a statistically isotropic homogeneous cosmic ray gas are worked out. Cosmic ray observations near earth give a cosmic ray energy density of 1.29×10^{-12} ergs/cm^3, a pressure of 0.45×10^{-12} dynes/cm^2, and a compressibility $\delta P/\delta N = 0.66\times10^{-12}$ ergs/cm^3. There is reason to believe that the interstellar values are not significantly higher than near Earth. Author

N66-15510# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
THE INTERPRETATION OF LIMB INTENSITY PROFILES
P. R. Wilson 12 Jul. 1965 26 p refs
(JILA-40)

Intensity profiles at the center of the H_α line in the chromosphere are calculated at various heights beyond the solar limb for several simple models of the absorption coefficient in the center of the line. Corresponding intensity distributions are determined as functions of height above the limb to see if there is an association between intensity profile and a particular optical depth. An abrupt change of gradient, which appears in both observed and calculated profiles, corresponds in height to a tangential depth of 1.3+0.3 for a wide variety of models. Radial and tangential optical depths and tangential intensity are discussed. M.W.R.

N66-15528# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
THE ROLE OF ALPHA PARTICLES IN SHIELDING AGAINST SOLAR EVENT RADIATION
J. W. Haffner 15 Jul. 1964 32 p refs
(SID-64-1297)

The role of alpha particles in the radiation emitted during solar events is investigated. It is shown from the available data that an average of 1 alpha particle is emitted for each 1.2 protons of the same kinetic energy. However, if shielding material is introduced, the fractional flux due to alpha particles decreases so that for shield thickness 1 gm/cm^2 it is less than 10 percent. However, the effectiveness of each alpha particle penetrating the shield for producing rad dose is four times that of each penetrating proton. If rem dose is considered, the relative effectiveness of each alpha particle is ~20 compared to each proton. Therefore, for shield thickness <3 gm/cm^2 the alpha particle contribute >20 percent of the total rad dose and >50 percent of the total rem dose. Therefore, it appears that in some cases appreciable dose underestimates will result if the alpha particle dose contributions are not included. Author

N66-15558# Lockheed-California-Co., Burbank. Physical and Life Sciences Lab.
STUDIES OF FLARE-ASSOCIATED FILAMENT PHENOMENA Final Report
I. F. Smith Jul. 1965 54 p refs
(Contract Nonr-4537(00))
(LR-19038; AD-622516) CFSTI: HC $3.00/MF $0.50

A study was made of the phenomena most frequently observed to occur or change preceding or accompanying the development of major flares. The changes referred to are only those occurring in the immediate vicinity of the flares and within two hours preceding the start of the flares. The frequency of occurrence of the observed changes were analyzed as a function of the time of occurrence relative to flare start, the wavelength of the observations, and the position on the solar disk. Preflare changes in absorption features were found to follow a definite statistical pattern. Two other events or changes were found to occur frequently within the same time interval as the pattern of changes in absorption features. These are (1) preflare brightenings and (2) bright and/or dark ejective phenomena. TAB

N66-15620*# Texas Western Coll., El Paso. Schellenger Research Labs.
AN ANALYSIS OF THE RELATION BETWEEN SOLAR RADIO EMISSION AND LARGE SOLAR COSMIC RAY INCREASES
Alexis Shlanta Jun. 1965 68 p refs
(Grant NgR-44-020-001)
(NASA-CR-69433) CFSTI: HC $3.00/MF $0.75 CSCL 20H

A statistical analysis has been made on solar radio outbursts associated with large solar proton events. Specific criteria have been established demonstrating that solar radio outbursts are indicative of these large solar cosmic ray increases. In addition, investigations have been made into false alarms, various time relationships, mixed-frequency combinations, and possible determinations of the size of a solar proton event. From these studies it has been found that there is a good correlation between specific signal characteristics of solar RF emission outbursts and large solar proton events. On decimeter wavelengths, these signal characteristics can be detected prior to the start of the PCA event. It has also been found that the false alarms can be considerably reduced if characteristics are specified on a combination of fixed frequencies rather than on only one frequency. In addition, there is an indication of a relationship between the area under the associated RF signal and the size of a solar proton event. Both Gold's and Parker's model of the interplanetary fields offer an explanation for some of the basic findings of this analysis. The results of this analysis can serve as the basic criteria for an electronic system that may provide a warning for large solar proton events. Such a warning system would reduce the corpuscular radiation hazard to future space flights. Author

N66-15695# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASURING LOW ENERGY PROTON ON THE KOSMOS-41 SATELLITE
S. N. Vernov, I. A. Savenko et al 10 Nov. 1965 14 p refs
Transl. into ENGLISH of a RUSSIAN paper presented at the Kospar Symp., Buenos Aires, 1965 9 p
(FTD-TT-65-1642/1+4; AD-623948) CFSTI: HC $1.00/MF $0.50

Protons with energy 0.4–7 mev and electrons of outer radiation belt were measured. It is concluded that: (a) The outer proton belt represents a relatively stable formation and the time variation involves only the outer part of the belt, beginning with L > or = 4.5 (b) The presence of an identical altitude process and the nature of variations of low energy rotons and rigid electrons of the outer radiation belt at L > or = 5 indicates a generalization for both types of radiation entrapment and acceleration mechanism. (c) Taking into consideration the dependence of these variations upon the geomagnetic arrangement, it can be assumed, that this mechanism appears to be an anomalous diffusion of particles in the magnetosphere of the earth on account of relatively weak nonstationary perturbation of the geomagnetic field, which is observed quite frequently. TAB

N66-15769*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CREW TRANSFER IN ORBITING SPACECRAFT
Norman Belasco [1963] 40 p Presented at the , Astronautical Soc. and AF Flight Test Center Symp. on Space Rendezvous Rescue and Recovery, 10 Sep. 1963
(NASA-TM-X-57112) CFSTI: HC $2.00/MF $0.50 CSCL 22A

The two primary problems common to the transfer of crew members in space, whether it be between vehicles in close proximity or between compartments of a single large vehicle, are reviewed. These are maneuverability/locomotion/propulsion in zero gravity, and protection and support during transfer. It is shown that in all transfer cases, the former must be accommodated in some manner since it appears impractical to

move the vehicle about the crew member. For the latter, except for cases of transfer which are completely in, from, to, and through pressurized compartments of the same vehicle or joined vehicles, a protective enclosure having an environmental control capability is required. Pertinent results of independent studies of these two problems are integrated and discussed relative to: (1) the factors limiting the time of transfer in a pressurized suit and the means for increasing allowable transfer time; (2) techniques of transfer; (3) design concepts of equipment for maneuvering/locomoting/stabilizing and propelling; (4) geometric dimensions of an inflated and occupied space suit; (5) configurations and dimensional requirements of air locks, hatchways, and transfer tunnels for ingress, egress, and performance of assigned tasks; and (6) detailed prediction of mobility that will be achieved in early extravehicular space suit design. R.R.D.

N66-15797# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
THE MOTION OF A CHARGED PARTICLE IN A MAGNETIC FIELD WITH APPLICATION TO SOLAR RADIATION PROTECTION
John O. Helgesen and Frank A. Spagnolo Oct. 1965 106 p refs
(RE-230; AD-473374)

An analysis is made of the motion of charged particles in a magnetic field generated by a superconducting, cylindrical solenoid of finite length. Regions around a particular solenoid configuration that are inaccessible to charged particles of a given energy are determined. Several solenoid configurations are analyzed to determine the magnet requirements for protecting the crew of a space vehicle from the radiation associated with solar flares. The results of this study indicate that a finite solenoid of a given magnetic moment is not as effective for radiation shielding as a dipole field of the same moment. These results, together with an assessment of magnet requirements indicate that materials must be developed that will maintain their superconductivity at field strengths exceeding 200 kilogauss before an effective shielding configuration can be obtained. Author (TAB)

N66-15801# Sacramento Peak Observatory, Sunspot, N. Mex.
DYNAMICS OF LIMB FLARES AND THE PINCH-EFFECT Solar Research Note
A. B. Severny and E. F. Shaposhnikova [1965] 22 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 27, 1960 p 235–257
(T-19; AD-624083) CFSTI: HC $1.00/MF $0.50

From 180 Ha films of limb flares, 25 were selected and 14 of these were studied in detail quantitatively. It was found that the great majority of flares above the limb appear as a brilliant hill, the upper front of which undergoes a rapid dilatation and then contraction. These dilatations and contractions are not uniform but show some pulsations. The corresponding accelerations of motion of the upper front are very high, from $5 \cdot 10^4$ to 10^6 cm/sec^2. The dilatations and contractions of these flare prominences are practically synchronous with variations of the bright region of the flare area. It is shown also that the increase of the distance of the front from the original "core" of the flare with time is more rapid than those observed for nuclear explosions. Simple computations show that in order to provide for the observed accelerations, assuming that they are caused by the expansion of hot plasma, the amount of heat energy released in flares should be $\sim 10^3$ ergs/cm^3 sec If this heat energy is a transformation of magnetic field energy due to pinch-effect, then the destruction of a magnetic field of the order of ~ 100 gs is sufficient to provide for this output. The electrodynamic acceleration of a current appearing in the neutral region due to the pinch-effect can attain the observed values if the strength of the surrounding field is ~ 100 gs. Author

N66-15855# Liege Univ. (Belgium). Inst. of Astrophysics.
MgI LINES IN THE SOLAR SPECTRUM Technical Note No. 2
J. W. Swensson and G. Risberg 31 Aug. 1965 49 p refs
(Contract AF 61(052)-685)
(AFCRL-65-822; AD-623872) CFSTI: HC $2.00/MF $0.50

Some of the results of a recent laboratory investigation of the spectrum of magnesium are presented in the form of a multiplet table giving wavelengths, intensities, excitation potentials, and line classifications for Mg I. Numerous predicted lines are also included in this table. On the basis of these data a search for magnesium lines in the solar spectrum has been carried out. It was found that 219 features in this spectrum can be attributed with certainty either wholly or partly to Mg I; 91 of these identifications are new. Certain line series are observed to higher n-values in the solar spectrum than in the laboratory. A determination of the mean wavelength displacements for the unblended Mg I lines in the Fraunhofer spectrum yields values ranging from +0.007 Å for the wavelength region 3093-6319 in the Revised Rowland Table to +0.12 Å for the 12084-24566 wavelength interval described in Mohler's table of solar spectrum wavelengths. The line shifts can not be explained solely in terms of a Doppler- or an Einstein shift. Author (TAB)

N66-15922# Tokyo Astronomical Observatory (Japan).
BULLETIN OF SOLAR PHENOMENA, VOLUME 16, NO. 4, OCTOBER-DECEMBER 1964
[1965] 21 p CFSTI: HC $1.00/MF $0.50

Sunspots, Ca Floculli, H_α Floculli, H_α dark filaments, solar flares, surges, active prominence regions, and sudden disappearances are tabulated. Also, the effective hours of the observation with the spectroheliioscope during October to December 1964 and the intensity of coronal emission line 5303 Å for the same period are tabulated. Solar radio emission observations at 17 000 and 227.5 Mc/sec are also given. E.E.B.

N66-16033# RAND Corp., Santa Monica, Calif.
MIXING LENGTH DAMPING AND SUNSPOTS
Paul S. Lykoudis Nov. 1965 18 p refs
(P-3249; AD-623803) CFSTI: HC $1.00/MF $0.50

An evaluation is made of the sunspot problem from the point of view of small magnetic Reynolds numbers allowing for slippage between the flow and the magnetic field. The evaluation is based on recently available laboratory experiments with liquid metal, which are predictable with a theory allowing for the damping of the turbulence, and therefore of the mixing length as a function of the magnetic field. TAB

N66-16054*# Aerospace Corp., El Segundo, Calif.
MODELS OF THE TRAPPED RADIATION ENVIRONMENT, VOLUME I: INNER ZONE PROTONS AND ELECTRONS
James I. Vette Washington, NASA, 1966 59 p refs
(NASA Order W-11683; Contract AF 04(695)-469)
(NASA-SP-3024) CFSTI: HC $1.00/MF $0.50 CSCL 20H

A description is given of a model which was developed for the inner radiation belt in order to determine accurate values of the fluxes and energy spectra of protons and electrons trapped in the geomagnetic field. Graphs are shown which give a picture of the radiations, and it is reported that card decks containing the actual flux values have been prepared and can

be used in subroutines of large computer programs. It is shown that the three quantities that need to be determined by comparing data from various sources are the flux distribution, the energy spectrum, and the absolute value, with the flux being, in general, a function of particle energy, time, position, and magnetic or solar activity. Relative to this emphasis was placed on dividing the environment into various segments of space, energy, and time so that simplifications of representation and use could be achieved. C.T.C.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N66-15222*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

EARTH-MOON TRAJECTORIES, 1965–70

R. J. Richard, V. C. Clarke, Jr., R. Y. Roth, and W. E. Kirhofer 15 Nov. 1965 590 p refs Revision 1

(Contract NAS7-100)

(NASA-CR-69223; JPL-TR-32-503, Rev. 1) CFSTI: HC $8.90/MF $2.75 CSCL 22C

This report gives key characteristics of Earth-to-Moon trajectories. It is intended to provide trajectory analysis with data, in volume, so that they may perform preliminary design studies and conduct investigations of the properties of ballistic lunar trajectories. While not exact, these trajectories are sufficiently accurate to be quite useful for the above purpose. The data presented assumed launch to occur at Cape Kennedy, arrival to occur when the Moon is over the meridian of the DSIF tracking station at Goldstone, California, and the flight time to be between 2 and 3 days. An explanation of the analytical model used in the generation of the data, including detailed equations, is presented. Author

N66-15223*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

HIGH-ENERGY TRAJECTORIES FROM EARTH TO MARS AND RETURN

S. S. Dallas 15 Dec. 1965 59 p refs

(Contract NAS7-100)

(NASA-CR-69221; JPL-TR-32-803) CFSTI: HC $3.00/MF $0.50 CSCL 22C

Speed increment requirements are investigated for various spacecraft trips. A three-dimensional analytic conic approximation to the accurate integrated trajectory, similar to the one used initially in the computation of one-way interplanetary trajectories, is used. The characteristics of the high-energy trajectories from Earth to Mars and return for the entire decade beginning January 1970 and ending January 1980 are investigated for four round-trip flight times of 67, 127, 247, and 487 days. The trajectories were computed by an IBM 7090 digital computer once for each day (zero hours GMT) in the decade. The energy information that is presented for the complete decade of launch dates can be used in parametric studies of advanced manned space flight missions to Mars. In addition, theoretical phenomena inherent in round-trip trajectories are discussed, including the occurrence of the out-of-ecliptic one-way trajectory or the nearly rectilinear one-way trajectory. Author

N66-15224*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

UTILIZING LARGE PLANETARY PERTURBATIONS FOR THE DESIGN OF DEEP-SPACE, SOLAR-PROBE, AND OUT-OF-ECLIPTIC TRAJECTORIES

M. A. Minovitch 15 Dec. 1965 85 p refs

(Contract NAS7-100)

(NASA-CR-69222; JPL-TR-32-849) CFSTI: HC $3.00/MF $0.75 CSCL 22C

This Report is concerned with three types of free-fall missions that are primarily designed for unmanned vehicles, viz. deep space, solar probe, and out-of-ecliptic missions. The energies required to attain these trajectories are beyond present direct-transfer capability using available boosters. Solar-impact and 90-deg-inclination trajectories require launch energies so high that second-generation nuclear upper stages or ion engines would be absolutely necessary. By utilizing large planetary perturbations, it is possible that a rocket like *Titan II-Centaur* with an extra kick stage can, by sacrificing a few extra pounds for planetary approach guidance, obtain trajectories that a *nuclear Saturn* V cannot obtain. Author

N66-15236*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE ORIGIN OF THE MOON

Paul D. Lowman, Jr. [1964] 16 p refs Submitted for Publication

(NASA-TM-X-56134) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Various studies attempting to shed light on the origin of the moon are discussed. Studies of the dynamical history of the Earth–Moon system, based on such verifiable quantities as changes in length of day, are considered promising; as is the study of lunar geology. Geological evidence on Earth which may have bearing on changes in the Moon's distance from the Earth; and geophysical discoveries, such as the Earth's non-equilibrium figure observed by Vanguard I, can also be applied to studies of the Moon's origin. M.W.R.

N66-15237*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE THEORY OF EVOLUTION OF COMPLETELY MIXED STARS WITH MASS LOSS

Richard Stothers [1965] 23 p refs Submitted for Publication

(NASA-TM-X-56075) CFSTI: HC $2.00/MF $0.50 CSCL 03B

It is found that cluster luminosity functions *per se* cannot be used to decide on the validity of the theory of homogeneous evolution of completely mixed stars with mass loss, since any observed function may be reasonably well produced by this Russian theory. The consequences are investigated for substituting the mass luminosity–mean molecular weight relation of stellar structure theory in place of the empirical relations. Although the mass loss rate becomes a free parameter, the stars still evolve along the main sequence. The theory of inhomogeneous evolution without mass loss is found to make definite predictions of the luminosity function. M.W.R.

N66-15244*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

[THE HELIUM CONTENT OF THE GALAXY]

A. G. W. Cameron [1964] 52 p refs

(NASA-TM-X-56132) CFSTI: HC $3.00/MF $0.50 CSCL 03B

It is usually assumed in modern theories of nucleosynthesis that the initial composition of the galaxy was pure hydrogen. The large solar and stellar content of helium has appeared to be a difficulty for such an assumption. Numerical studies are made of the time changes in the compositions of stars and

the interstellar medium as a result of stellar evolution. It is concluded that the large helium content of the sun and recently-formed stars can only be produced as a result of the evolution of stars of approximately solar mass. Hence the initial hydrogen hypothesis requires a large age for the galaxy ($\geq 2 \times 10^{10}$ years). The content of long-lived radioactivities in the interstellar medium is also followed as a function of time. It is found that the ratios of radioactivities are very insensitive functions. Author

N66-15247*# California Inst. of Tech., Pasadena.
THE GENERAL RELATIVISTIC INSTABILITY OF MASSIVE STARS
William A. Fowler 6 Nov. 1964 22 p *Its* Orange Aid Series Presented in part at the Joint Discussion on Radio Galaxies, 12th Gen. Assembly of the Intern. Astrophys. Union, Hamburg, 27 Aug. 1964 and in part at the 13th Solvay Congr., Brussels, 24 Sep. 1964 Submitted for Publication
(Grant NgR-05-002-028; Contract Nonr-220(47))
(NASA-CR-60768) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Binding energy of a massive polytrope in hydrostatic equilibrium is discussed in connection with the general relativistic instability of massive stars. Critical radius, temperature, and density for the onset of dynamical instability are considered as is general relativistic gravitational collapse. In spherically symmetric general relativistic collapse, the time scale for the release of nuclear energy is very short; for $M \geq 10^7 M_\odot$ the collapse is not stopped at all even though the nuclear resources seem to be adequate to stop and reverse the collapse. Oscillations of the star then become possible if adequate modes of energy transmission to and from the surface are available. Shock wave phenomena leading to the generation of high energy particles presumably come into play and may lead to the excitation of the hydrogen 2 and radio-emitting regions surrounding the quasi-stellar objects. Discussions relating to the review are included. M.W.R.

N66-15305*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
EXPERIMENTAL INVESTIGATION OF ULTRA-HIGH VACUUM ADHESION AS RELATED TO THE LUNAR SURFACE Sixth Quarterly Progress Report, 1 Oct.–31 Dec. 1965
J. A. Ryan [1965] 30 p ref
(Contract NAS7-307)
(NASA-CR-69246) CFSTI: HC $2.00/MF $0.50 CSCL 22A

Progress is reported on several equipment modifications. These include the replacement of the mechanical forepump by sorption pumps, and the installation of a new experimental chamber which permits utilization of an electron gun and allows vacuum cleavage to be performed. Further, a device for vacuum cleaving was designed and built; and preliminary tests of this device in air indicated that it performed satisfactorily. The data obtained relate principally to the effects of the type of forepump, data repeatability, crystalline orientation effects, roughness effects, and surface damage and material transfer. It was found that: (1) The type of forepump used had no discernible effect on the data obtained. (2) The data appeared to be reasonably reproducible. (3) Crystalline orientation effects relatable to crystalline structure were present, but that further work would be required before a definite conclusion can be reached. (4) Decreasing surface roughness resulted in an increase in the magnitude of the low load adhesion, indicating that the dispersion forces were responsible for this adhesion. (5) Surface roughness was not responsible for surface damage and material transfer, thus strengthening the argument that these are produced through the action of the normal atomic bonding forces. R.R.D.

N66-15308*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
MISSIONS TO THE COMETS
F. Marin, D. L. Roberts, and P. M. Pierce Dec. 1965 41 p refs
(Contract NASr-65(06))
(NASA-CR-69249; M-9) CFSTI: HC $2.00/MF $0.50 CSCL 22A

The feasibility of unmanned scientific missions to well-known short-period comets and to new comets in the years 1965–1986 is discussed. An analysis of the possible opportunities for missions to periodic comets indicates that the apparitions of at least 17 periodic comets are suitable for intercept missions in the next 20 years, and that 5 are of particular interest. In addition, given a modest sky-searching facility such as can be provided with Baker-Nunn or similar cameras, the potential opportunities for intercept missions to new comets are nearly 1 per year. It is shown that not only are the number of opportunities for comet missions sufficient, but both the experimental and the total payloads are also within the foreseeable state of the art and are compatible with projected launch vehicle capabilities. R.R.D.

N66-15319*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALIBRATION OF THE HERTZSPRUNG-RUSSELL DIAGRAM IN TERMS OF AGE AND MASS FOR MAIN-SEQUENCE B AND A STARS
T. Kelsall and Bengt Stromgren (Inst. for Advanced Study) [1965] 37 p refs Submitted for Publication
(Contract Nonr 1858)
(NASA-TM-X-56081) CFSTI: HC $2.00/MF $0.50 CSCL 03A

Calculations of evolutionary model sequences for main sequence B and A stars are discussed, with emphasis upon the recent availability of improved values of the energy generation and opacity functions. The calibration of the Hertzsprung-Russell diagram presented was derived from the results of the Kelsall evolutionary model sequence calculations. Tables and figures are also presented. It is pointed out that although ages of very satisfactory accuracy can can be obtained for stars in the favorable region of the Hertzsprung-Russell diagram considered, the age calibration was derived on the assumption that the stars are nonrotating and that the structure is not influenced by magnetic fields. R.R.D.

N66-15322*# California Inst. of Tech., Pasadena.
EVOLUTION II: FROM THE MAIN SEQUENCE THROUGH CORE HELIUM BURNING, M=3M$_\odot$
Icko Iben, Jr. [1964] 51 p Submitted for Publication
(Grant NGR-05-002-208; Contract Nonr-220(47))
(NASA-CR-60828) CFSTI: HC $3.00/MF $0.50 CSCL 03B

A three solar mass stellar model of population I initial composition is evolved from the main sequence to the stage of helium exhaustion in the core. Out of the total time elapsed, three-fourths is spent near the main sequence with hydrogen burning in the core and one-fourth is spent in the red-giant region with helium burning in the core combined with hydrogen burning in a shell. During the rise toward the red-giant tip immediately preceding the ignition of helium in the core, the extension of a convective envelope almost to the hydrogen-burning shell then leads to an increase in the surface ratio of N^{14} to C^{12} by a factor of 3.2 and to a decrease in the surface abundance of Li by a factor of 60. Surface abundances do not change further during core helium burning. Comparison with the surface Li abundance of Capella F and G permits an interference concerning the average rate of mass loss from the surface of a three solar mass star. Author

N66-15338*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TRANSLATIONAL AND ROTATIONAL MOTION OF A BODY ENTERING THE MARS ATMOSPHERE

Peter Hans Feitis 1 Dec. 1965 47 p refs Presented at the Joint Ann. Meeting of the WGLR-DGRR, Berlin, 16 Sep. 1964 Submitted for Publication
(NAS7-100)
(NASA-CR-69252; JPL-TR-32-845) CFSTI: HC $2.00/MF $0.50 CSCL 03B

In the present paper, the density distribution within the Martian atmosphere is derived as a function of altitude and the atmospheric parameters. The equations of motion of simple bodies are established and solved. The case of oblique entry into the atmosphere is also treated. The second part discusses a sphere entering the atmosphere. It is assumed that the center of gravity of the sphere does not coincide with its center. The diameter containing the sphere's center of gravity will be called its "axis." In the third part, the results obtained above are compared with the exact solutions. For the exact solution, a numerical integration of the equations of motion is carried out taking into account all forces neglected above. It is seen that the new theory of motion is a considerable improvement over the old theories. Author

N66-15348*# Northrop Space Labs., Hawthorne, Calif.

TECHNOLOGY UTILIZATION WORKSHOP SUBJECTS STUDY, SUPPLEMENT 1

D. E. Kaufman and W. E. Brooner Jun. 1964 20 p
(Contract NAS7-277)
(NASA-CR-69288; NSL-64-125-1) CFSTI: HC $1.00/MF $0.50 CSCL 05A

The Technology Utilization Program was analyzed and evaluated in terms of organization, composition and participation, and actual extent of information dissemination. Problems elucidated at the plenary meeting concerned definitions of specific industry needs, modifications to government procurement and administrative procedures, motivation for extended commercial research, and methods for identifying new technology. Technological areas of discussion included space electrical power systems, metal forming, materials and structures, valves and pumps, biomedical research, electronics and optics, and management concepts. Conclusions and recommendations covered the need for a bold confident approach, for better advertising, for more diversified industry participation and increased time for question and answer periods, and for pre-editing of presented material. D.T.

N66-15357*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

STATISTICAL ANALYSIS OF PHOTOGRAPHIC METEOR DATA. PART II: VERNIANI'S LUMINOUS EFFICIENCY AND SUPPLEMENTED WHIPPLE WEIGHTING

Charles C. Dalton 18 Nov. 1965 34 p refs
(NASA-TM-X-53360) CFSTI: HC $2.00/MF $0.50 CSCL 03B

This report is Part II in a series of four reports on the statistical analysis of the Hawkins and Southworth random sample of 285 sporadic photographic meteors. The four parts of the analysis comprise the combinations from two alternative formulations for meteoroid mass and two alternative formulations for data weighting. Parts I and II have the same weighting as a function of air-entry velocity and other parameters. But the surprisingly large disparity between the results with Opik's luminous efficiency suggests the possibility of considerable bias from weighting inversely with 1.5-power of velocity. Author

N66-15362*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPLICIT GUIDANCE EQUATIONS FOR MULTISTAGE BOOST TRAJECTORIES

Fred Teren Washington, NASA, Jan. 1966 41 p refs
(NASA-TN-D-3189) CFSTI: HC $2.00/MF $0.50 CSCL 22C

Explicit guidance equations are developed for steering multistage launch vehicles to injection conditions that satisfy typical lunar impact requirements. The calculus of variations is used to derive the required boundary conditions on the thrust direction at staging points. An approximate variational yaw steering law is also derived in order to minimize the payload loss in removing yaw velocity errors. The equations are programed for steering the Atlas-Centaur vehicle on the direct-ascent Surveyor mission. Results are presented that demonstrate targeting accuracy and payload capability (compared with optimized open-loop trajectories). Author

N66-15371*# Little, Arthur D., Inc., Cambridge, Mass. Research and Development Div.

THE EFFECT OF THE LUNAR ENVIRONMENT ON MAGMA GENERATION, MIGRATION, AND CRYSTALLIZATION, AUGUST 13, 1964–AUGUST 20, 1965

R. K. Mc Connell, R. V. Allen, J. Aronson, G. Feick, D. W. Lee et al 1 Nov. 1965 164 p refs
(Contract NAS9-3449)
(NASA-CR-65186) CFSTI: HC $5.00/MF $1.00 CSCL 03B

Studies of several models of lunar composition indicate that a period of intense volcanic activity with sudden onset and approximately exponential decline is entirely likely. A mechanism for sudden generation of magma is proposed on the basis of the thermal properties of a basalt-dunite mixture. Factors controlling the migration of magma through a dike, the formation of magma chambers and the deposition of volatile species on the moon's surface are discussed. Author

N66-15382*# Florida Univ., Gainesville. Dept. of Physics and Astronomy.

DEVELOPMENT OF AN ORBITAL RECEIVER FOR LOW-FREQUENCY RADIO ENERGY FROM THE PLANET JUPITER Final Report, 1 Jun. 1964–30 Sep. 1965

[1965] 47 p refs
(Contract NASr-176)
(NASA-CR-69340) CFSTI: HC $2.00/MF $0.50 CSCL 03A

The design studies of an orbital receiving system capable of detecting the low frequency radio energy from the planet Jupiter are summarized and the prototype low frequency radiometric receiving system is described. The prototype receiving system is a four-channel superheterodyne total power radiometer. A photograph of the system is shown. The four-channel radiometer is designed as an integral unit in that each channel shares a common antenna, calibration source, programmer, and power supply. Results of tests on gain versus bandwidth for each channel at two separate input levels are shown graphically. E.E.B.

N66-15386*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PUBLICATIONS OF THE JET PROPULSION LABORATORY, JULY 1964 THROUGH JUNE 1965

Royal L. Woods ed. 15 Dec. 1965 74 p refs
(Contract NAS7-100)
(NASA-CR-69354; JPL-BIBL-39-6) CFSTI: HC $3.00/MF $0.75 CSCL 05B

Abstracts of technical reports and memoranda are presented. Technical reports are designed to report on a single significant development; on the completion of a recognizable phase, or on the completion of an entire project; or may record data

or a development growing out of an assigned project but not directly related to it. Technical memoranda report the results of a special study of a problem, provide preliminary information on a project, or present any other material which is intended for a limited audience. E.E.B.

N66-15398*# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
A MODEL OF THE QUASI-STELLAR RADIO VARIABLE CTA 102
M. J. Rees and D. W. Sciama [1965] 11 p refs
(Grant NsG-58)
(NASA-CR-69349) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The quasi-stellar radio source CTA 102 has a variable flux density at 32.5 cm with a period of about 100 days. This has been taken to mean that the source cannot be larger than about 0.1 pc, which is the distance light travels in one period. Since the angular diameter of the source is not less than about 0.01", it is also concluded that the source must be closer than 2 Mpc and possibly within the solar system. However the optical object identified with CTA 102 has a red shift of 1.037 and thus is probably at a distance comparable with the radius of the universe. A model is proposed which assumes that the observed variations originate in the source itself and is consistent with the red shift observations. E.E.B.

N66-15399*# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.
OPTIMUM TRANSFER TO MARS VIA VENUS
Walter M. Hollister and John E. Prussing Apr. 1965 45 p refs
(Grant NsG-254-62)
(NASA-CR-69348; RE-16) CFSTI: HC $2.00/MF $0.50 CSCL 22C

This report describes an investigation into the advantages of a thrust maneuver near Venus during a round trip mission to Mars. Optimum thrusted flybys of Venus have been computed for practical dates at Earth and Mars between 1970 and 1990. It was found that the use of thrust during the flyby of Venus does offer savings over the pure flyby without thrust, but from a practical point of view they do not appear significant. The conclusions apply only to the specific type of Earth-Mars transfer for a round-trip stopover mission which was studied. The method of analysis is applicable to any interplanetary flyby trajectory. Author

N66-15400*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ULTRAVIOLET SPECTROSCOPY OF PLANETS
Charles A. Barth 15 Dec. 1965 261 p refs
(Contract NAS7-100)
(NASA-CR-67597; JPL-TR-32-822) CFSTI: HC $5.00/MF $1.00 CSCL 03B

The ultraviolet spectrum of a planet is produced by the following physical processes: (1) dayglow, the scattering of solar photons by atoms and molecules in the upper atmosphere of the planet; (2) daylight, the combination of rayleigh scattering of solar radiation and absorption by atmospheric constituents that produces the planetary albedo in the ultraviolet; and (3) electron excitation, the excitation of atoms and molecules in the upper atmosphere by auroral electrons and by photoelectrons. A quantitative description of each of these processes is given. The atoms and molecules that are prominent in planetary ultraviolet spectra are listed. Calculations are given of planetary molecular emission spectra that are the result of optically thin and optically thick fluorescent scattering and of excitation by auroral bombardment and by photoelectrons. Rocket measurements of the dayglow spectrum of the Earth are given for the spectral region between 2000 and 4000 Å. Author

N66-15425*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LUNAR IMPACT CRATERS
Paul D. Lowman, Jr. [1964] 12 p Submitted for Publication
(NASA-TM-C-56115) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Selected lunar craters ascribed to impact are described, and two major classes are identified: primary craters, formed directly by bodies falling from space; and secondary craters, formed by ejecta from primary craters. Details are given on the topography and structure of Copernicus, and evidence that it is an impact crater is summarized. Main points include: (1) existence of large impact craters on earth; (2) independence of structural trends; (3) one-stage formation; (4) great size; and (5) similarity to terrestrial impact craters. A comparison is drawn between Eratosthenes and Copernicus, and the similarity found implies an impact origin for both. The older craters—Archimedes, Grimaldi, and Clavius—are also described, and the effect of major geological events on their structure are pointed out. Theories on an impact origin for the circular maria are also examined. Evidence for the origin of secondary impact craters includes the existence of similar features around terrestrial explosion craters, their gradational relationship with the ejecta blanket, and their association with rays. It was generally concluded that although much of the moon's surface is volcanic rock, most landforms are chiefly the direct or indirect result of meteoritic impact. M.G.J.

N66-15428# Royal Observatory, Edinburgh (Scotland).
OBSERVATIONS OF INTERSTELLAR REDDENING. II: RESULTS FOR REGION IN PERSEUS
K. Nandy HMSO, 1965 22 p refs *Its* Publ., Vol. 5, No. 2
HMSO: 6s 6d

Interstellar reddening law in the direction of Perseus over the wavelength range from 8000 to 3450 Å is investigated, and a comparison is made of reddening in Perseus and Cygnus. Spectrophotometric measurements of O and B-type stars, in groups or separately, indicate that variations in reddening curves are less than ±5% and well within the range of accidental errors of observation. In both regions, mean reddening curves can be represented by two straight lines which intersect near 4300 Å, but the ratio of the slope of the ultraviolet portion of the curve to the blue visible part is .64 for the Cygnus and .46 for the Perseus reddening curve. M.W.R.

N66-15478*# Texaco Experiment, Inc., Richmond, Va.
A THEORETICAL STUDY OF THE PROPAGATION AND ATTENUATION OF ACOUSTIC WAVES IN THE LUNAR SURFACE Interim Report
R. L. Wolf and R. E. Canup 9 Feb. 1962 17 p ref Prepared for JPL
(Contract JPL-950155)
(NASA-CR-69393; EXP-387) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Computations were made of the decrease in displacement of waves with frequencies from 25 to 3500 cps in passing through an attenuating medium. The usual attenuation equations were used with constants which have been determined by seismological experiments. Calculations were made at 2-ft intervals for 2 to 20 ft of wave travel. Author

N66-15490*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MINIMUM PROPELLANT CONSUMPTION ROUND-TRIP TRAJECTORIES TO MARS FOR CONSTANT-THRUST, CONSTANT-SPECIFIC-IMPULSE VEHICLES WITH OPTIMUM COASTING PERIODS
Charles L. Zola and Laurence H. Fishbach Washington, NASA, Jan. 1966 34 p refs
(NASA-TN-D-3233) CFSTI: HC $2.00/MF $0.50 CSCL 20C

Propellant consumption data are presented for constant-thrust, low-acceleration, Earth-Mars round-trip trajectories including escape and capture spirals at both planets. Calculations are based on a previous analysis in which the calculus of variations was applied to the problem of minimizing the propellant consumption of the round-trip trajectory treated as a single unit. Solutions given are for initial accelerations between 1.0 and 4.0×10^{-3} meter per second squared and include optimum coast phases. Results for short trip times between 340 and 460 days and a long trip time of 1000 days are presented with various wait times at Mars. Also included are examples of mission profiles where the first and/or last Earth spirals are deleted. A simple example is given showing how data of the type presented may be used for mission analysis. The mission profiles and their data are limited in scope because of computational difficulties. These results, therefore, are not sufficient for a complete study of the Mars round-trip mission.
Author

N66-15504# Royal Observatory, Edinburgh (Scotland).
ROTATION OF THE SILICON AND MANGANESE STARS
B. N. G. Guthrie HMSO, 1965 20 p refs *Its* Publ., Vol. 5, No. 1 Available from HMSO, Edinburgh: 5s 6d

A discussion of line widths indicates a preponderance of sharp-line stars in the Mn group but not in the Si-4200 group, although the colours of the two groups are the same. The most likely explanation is that an overabundance of manganese is formed near the pole in Mn stars, while Si-4200 stars have an overabundance of silicon over most of their surfaces. The significant factor distinguishing the two groups may be the direction of the magnetic field in relation to the axis of rotation.
Author

N66-15520# Australian National Univ., Canberra. Mount Stromlo Observatory.
SYMPOSIUM ON THE MAGELLANIC CLOUDS
J. V. Hindman (Commonwealth Sci. and Ind. Res. Organ.), B. E. Westerlund, and E. R. Wilkie, ed. [1965] 112 p refs Symp. held 18–20 May 1965
CFSTI: HC $4.00/MF $0.75

Various aspects of Magellanic clouds are considered in a review of papers and discussions presented at a symposium. Galaxies, cepheids and stellar birth-rates, planetary nebulae, and radial velocities are considered. Neutral hydrogen, globular clusters, Wolf-Rayet stars, and interstellar polarization in Magellanic clouds are discussed; and the structure of these clouds and effects from past explosions are reviewed. Results of continuum and other observations are presented.
M.W.R.

N66-15541*# Space Technology Labs., Inc., Redondo Beach, Calif.
STUDY OF UNMANNED SYSTEMS TO EVALUATE THE MARTIAN ENVIRONMENT. VOLUME II: EXPERIMENTS
Robert L. Sohn and Paul Dergarabedian 23 Sep. 1965 94 p refs
(Contract NAS2-2478)
(NASA-CR-68741; STL-5303-6014-TU-000) CFSTI: HC $3.00/MF $0.75 CSCL 22A

Requirements for experiment programs for the measurement of Martian and Cismartian environmental factors by unmanned precursor missions, based upon the results of a preceding sensitivity analysis, are summarized. Consideration is given to such factors as design feasibility, essential design criteria, system weight, mission operation, and system development. The priorities for the experiments in order of their importance are: solar cosmic radiation environment, meteoroid environment, and atmospheric properties. A list of instruments was prepared, including physical descriptions, to accomplish the required experiments This list is divided into groups according to mission mode requirements (interplanetary, orbiter or capsule/lander), and spacecraft weight capability. It is apparent from the results of the study that the interplanetary environment, particularly solar cosmic radiation and meteoroid flux, are key factors in the design and operation of the manned mission. In contrast, uncertainties in the definition of the Martian atmosphere do not have a dominating impact on the design of the manned system. Techniques for measuring the atmosphere are discussed, and limitations of experiments yielding indirect measurements delineated.
M.R.W.

N66-15542*# Space Technology Labs., Inc., Redondo Beach, Calif.
STUDY OF UNMANNED SYSTEMS TO EVALUATE THE MARTIAN ENVIRONMENT. VOLUME IV: SUMMARY
Robert L. Sohn and Paul Dergarabedian 23 Sep. 1965 24 p (Contract NAS2-2478)
(NASA-CR-68743; STL-5303-6016-TU-000) CFSTI: HC $1.00/MF $0.50 CSCL 22A

A study of the sensitivity of the manned Mars mission to the Martian and Cismartian environment, and a definition of the experiments and unmanned spacecraft to acquire the necessary environment measurements, is reported. The general goals of the study were to: identify those environmental factors that can influence the planning and design of the manned Mars mission; establish the sensitivity of the manned Mars mission system to uncertainty in the Martian and Cismartian environment; define experiments and instrumentation required to make the necessary measurements of the significant environmental factors; and design unmanned systems to evaluate the Martian and Cismartian environment, based on the priorities established from the sensitivity analyses.
M.R.W.

N66-15546# Instituto y Observatorio Astronomico de Marina, San Fernando (Spain).
NAUTICAL ALMANAC FOR 1966 [ALMANAQUE NAUTICO, ANO 1966]
1965 486 p In SPANISH
CFSTI: HC $7.00/MF $2.25

A 1966 nautical almanac is presented and contains tabulated data on general astronomical constants; phases of the moon; lunar and solar eclipses; maps of solar eclipse paths; horary angle and declination of the sun, moon, and four planets (Venus, Mars, Jupiter, and Saturn); apparent positions of stars; rising and setting of the sun and moon; passing of Aries, sun, moon, and planets by the Greenwich meridian; polar star latitudes and azimuths; latitude corrections for sun, moon, planets, and stars; tide predictions; geographical positions of principle world ports; and Greenwich time in different countries.
Transl by R.N.A.

N66-15551# Lockheed-California Co., Burbank. Astrodynamic Research Div.
ORBIT ANALYSIS OF COMMUNICATION SATELLITES Final Report, 8 Oct. 1963–1 Jun. 1964

Robert M. Baker, Ray De Ballis, and K. Forster Griffiss AFB, N. Y., RADC, Sep. 1964 234 p refs
(Contract AF 30(602)-3238)
(LR-17944; RADC-TDR-64-314; AD-449418)

This report contains theoretical analyses on the astrodynamics of a solar sailing satellite. The purpose of this report is to provide technical reviews, evaluations, and recommendations related to the astrodynamics portion of a solar sailing satellite, development of an orbit differential correction procedure, and determination of a control philosophy for orbital correction maneuvers. The analyses are mainly qualitative in content; therefore, the course of action followed has been analytical in nature. Numerical analysis has been introduced as necessary, but has been kept to a minimum to avoid a compendium of tables. The analyses, however, are described so that they may be programmed on a computer with a minimum of rearrangement. The specific results and conclusions reached in this study are contained in the respective section for each analysis. Author (TAB)

N66-15578*# Bendix Corp., Southfield, Mich. Research Labs Div.
MASS SPECTROMETER FOR LUNAR ANALYSIS STUDY Final Summary Report, 1 Jun.–31 Aug. 1963
G. J. O'Halloran, L. D. Ferguson, F. W. Poblenz, and L. Walker 30 Nov. 1963 180 p refs
(Contract NAS8-5370)
(NASA-CR-69447; RLD-2542) CFSTI: HC $5.00/MF $1.00 CSCL 03A

A general discussion is presented regarding the desirability of a lunar compositional analysis, and the operational and environmental constraints at launch, voyage, approach, and landing. A compilation of the lunar atmosphere and soil models is given, and an analysis of the measurements that are to be made is included. Compositional analysis techniques are considered, and include a parametric evaluation of sensor systems and a comprehensive discussion of time-of-flight spectrometry. C.T.C.

N66-15597*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CREW TRANSFER IN ORBITING SPACECRAFT
Norman Belasco [1963] 40 p Presented at the Am. Astronautical Soc. and AF Flight Test Center Symp. on Space Rendezvous Rescue and Recovery, 10 Sep. 1963
(NASA-TM-X-57112) CFSTI: HC $2.00/MF $0.50 CSCL 22A

The two primary problems common to the transfer of crew members in space, whether it be between vehicles in close proximity or between compartments of a single large vehicle, are reviewed. These are maneuverability/locomotion/propulsion in zero gravity, and protection and support during transfer. It is shown that in all transfer cases, the former must be accommodated in some manner since is appears impractical to move the vehicle about the crew member. For the latter, except for cases of transfer which are completely in, from, to, and through pressurized compartments of the same vehicle or joined vehicles, a protective enclosure having an environmental control capability is required. Pertinent results of independent studies of these two problems are integrated and discussed relative to: (1) the factors limiting the time of transfer in a pressurized suit and the means for increasing allowable transfer time; (2) techniques of transfer; (3) design concepts of equipment for maneuvering/locomoting/stabilizing and propelling; (4) geometric dimensions of an inflated and occupied space suit; (5) configurations and dimensional requirements of air locks, hatchways, and transfer tunnels for ingress, egress, and performance of assigned tasks, and (6) detailed prediction of mobility that will be achieved in early extravehicular space suit design. R.R.D.

N66-15613*# Manchester Univ., Macclesfield (England).
[PHOTOGRAPHIC OBSERVATIONS OF LUNAR SURFACE FROM JAPAN] Final Status Report, 15 Feb.–15 Aug. 1965
[1965] 10 p
(Grant NsG-297-63)
(NASA-CR-69485) CFSTI: HC $1.00/MF $0.50 CSCL 03A

The objectives and importance of a sustained program of lunar photography at an observatory located geographically approximately 120° east of the Greenwich meridian are presented. Such an observational window facilitates photographic coverage of the moon at times when the planet is below the horizon at Pic-du-Midi and at the Lowell Observatory and other large observatories in the Western United States. The Kwasan Observatory stands in an elevated position overlooking Kyoto and shares the atmosphere of a smokey city that has extended its boundaries almost to the gates of the observatory. Consideration was given to moving the Kwasan instruments to more favorable positions away from industrial smoke. Sites such as Utsukushigahara, near Matsumoto in the Japanese Alps were considered. During the period negatives 12358 were secured with the 24-inch reflector and the modified K-24 camera. This yielded an average of nearly 50 negatives/epoch. E.E.B.

N66-15616*# Wisconsin Univ., Madison.
STELLAR SPECTROPHOTOMETRY IN THE FAR ULTRAVIOLET Final Report, Jul. 1959–Dec. 1963
Arthur D. Code [1964] 16 p refs
(Contract NASw-66)
(NASA-CR-69482) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The program of research was directed toward the study of stellar spectrophotometry in the vacuum ultraviolet. The early phases of this work were directed toward the design of a small 300-pound satellite for ultraviolet spectrophotometric measurements. This study provided the basis for the design of a larger Wisconsin experimental package for the Orbiting Astronomical Observatory. In the course of this work laboratory instrumentation was developed for testing and calibrating vacuum UV optical equipment and for the fabrication of UV interference filters and mirror coatings. The latter phases of the research included the design and construction of a stable platform for use in the X-15 rocket plane in order to conduct ultraviolet measurements with the aircraft. Author

N66-15626*# National Academy Sciences—National Research Council, Washington, D. C. Space Science Board.
SPACE RESEARCH: DIRECTIONS FOR THE FUTURE, PART TWO
Jan. 1966 223 p refs
(Contract NSR-09-012-903)
(NASA-CR-69494) CFSTI: HC $6.00/MF $1.25 CSCL 03A

Future space research activities are recommended and outlined for the following faculties: (1) *Optical Astronomy*—research objectives and programs, and application of a large orbital telescope; (2) *Solar Astronomy*—current solar problems, specific vehicles and instruments, wavelength regions, spectroheliograms, etc.; (3) *Radio and Radar Astronomy*—long-wave radio astronomy, millimeter-wave and long-wave infrared astronomy, and radar astronomy; (4) *X-Ray and Gamma-Ray Astronomy*—current state of observations, theoretical considerations, methods of observation, vehicle requirements, and observations making use of man in space; and (5) *Physics and Geophysics*—possible experiments in space. G.G.

N66-15678# Royal Aircraft Establishment, Farnborough (England).
RESONANCE EFFECTS FOR SATELLITES WITH NOMINALLY CONSTANT GROUND TRACK

R. R. Allan Aug. 1965 24 p refs
(RAE-TR-65232) CFSTI: HC $1.00/MF $0.50

Since a constant-ground-track satellite would continually pass over the same regions of the Earth, such orbits are in resonance with the longitude dependent part of the Earth's gravitational field. The situation is similar, but not completely analogous, to the case of synchronous satellites. For β revolutions per day, the ground track will oscillate in longitude with a maximum amplitude of $\pm 180/\beta$ degrees, the periods of oscillation being usually of the order of a few years for $\beta = 2$, 3 and 4. These effects depend strongly on the inclination of the orbit. Author

N66-15700# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
INTERNAL STRUCTURE OF THE MOON
Zdenek Kopal Sep. 1965 218 p refs *Its* Mathematical Note No. 426
(DI-82-0466; AD-624047) CFSTI: HC $6.00/MF $1.25

The internal structure of the moon and its evolution are discussed. Some topics considered are: hydrostatic equilibrium; thermal history of the moon; stress history of the moon; possible convection in lunar interior; chemical composition of the moon; lunar exosphere. TAB

N66-15729*# Honeywell, Inc., St. Petersburg, Fla. Military Products Group.
NASA PATTERN RELEVANCE GUIDE. VOLUME I: GENERAL, SPACE SCIENCE AND UTILIZATION
Richard H. Parvin 1 Dec. 1965 287 p refs Revised
(Contract NAS8-20207)
(NASA-CR-69536; MH-AERO-820207-RG) CFSTI: HC $5.00/MF $1.50 CSCL 22A

Information for use in assigning relevance to elements on the PATTERN relevance tree is summarized. The PATTERN (planning assistance through technical evaluation of relevance numbers) is described as a management planning aid used to determine the relevance of space programs or concepts for accomplishing specific tasks, and hence the technology deficiencies involved in each program. Material relevant to voting the first four levels of the PATTERN tree is discussed, including (1) the United States and Soviet goals and capabilities in space; (2) the scientific exploration of space and the use of space for practical purposes; (3) the summary reasons for interest in each target of space exploration and utilization; (4) the scientific disciplines involved and how they will benefit from space flight; and (5) the principal tasks or scientific interests in each discipline. Astronomical reference tables, and lists of space sciences tasks are also included. M.G.J.

N66-15732*# Philco Corp., Palo Alto, Calif. WDL Div.
PROGRAMMER'S MANUAL FOR INTERPLANETARY ERROR PROPAGATION PROGRAM
15 Nov. 1963 421 p
(Contract NAS5-3342)
(NASA-CR-69535; WDL-TR-2184) CFSTI: HC $7.21/MF $2.25 CSCL 22C

This report discusses the subroutines that are used in the interplanetary error propagation program. A narrative description and card listing are provided for each subroutine; flow diagrams are included, if applicable. A listing of assigned locations in common is also presented. Author

N66-15742# Joint Publications Research Service, Washington, D. C.
PECULIARITIES IN THE MOTION OF FINE METEORIC BODIES
B. L. Kashcheyev, V. N. Lebedinets, and M. F. Lagutin 6 Jan. 1966 13 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Ser. Mat. Fiz. (Moscow), v. 164, no. 4–6, 1965 p 1256–1259
(JPRS-33614; TT-66-30058) CFSTI: $1.00

Data obtained from a yearly cycle of radar measurements of individual radiants and of meteoric velocities are analyzed, and the factors considered in processing the material are discussed. The distribution of the orbit elements of small meteoric objects is graphed, and compared with the photographic distribution of the orbits of 2500 meteors brighter than +3 of stellar magnitude, and 144 meteors brighter than 0 of stellar magnitude. Photographic observations showed two basic types of large meteoric object orbits, one similar to the orbits of short-period comets, the other similar to long-period comets. The basic radar observation uncovered two additional orbits, characteristic of small meteoric objects: (1) orbits with eccentricity < 0.7 and $30° <$ inclination $< 165°$, and (2) the bulk of small meteoric objects moving on elongated orbits with eccentricity > 0.7 which are, in shape, close to short-period comet orbits but with significantly smaller perihelion distances and dimensions. It was concluded that the presence of meteoric currents with elongated orbits indicates that the solar system contains a large number of short period comets with such type orbits. M.G.J.

N66-15806# National Aeronautics and Space Council, Washington, D. C.
REPORT TO THE CONGRESS FROM THE PRESIDENT OF THE UNITED STATES: UNITED STATES AERONAUTICS AND SPACE ACTIVITIES, 1965
Lyndon B. Johnson 31 Jan. 1966 182 p

Outstanding progress in both aeronautics and space accomplishments is reported for the year 1965. The largest number of spacecraft was successfully orbited; Moon and Mars were photographed at close range; manned space flight activities reached new peaks; space research provided increasing benefits for mankind; national security was augmented; and the technological, scientific, and managerial capabilities increased. Highlights of the manned space flight program were the extra-vehicular activities and the rendezvous of two Gemini vehicles in space. G.G.

N66-15807*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
CRITICAL MEASUREMENTS ON EARLY MISSIONS TO JUPITER
J. M. Witting, M. W. P. Cann, and T. C. Owen Dec. 1965 127 p refs
(Contract NASr-65(06))
(NASA-CR-69561; P-10) CFSTI: HC $4.00/MF $1.00 CSCL 22A

Existing knowledge of Jupiter's magnetosphere, ionosphere, atmosphere, and interior is summarized and critical measurements which can be made from fly-by missions to Jupiter are indicated. Estimates place Jupiter's surface magnetic field strength at about 10 gauss, indicating the presence of radiation belts with 1000 times greater particle densities than those of Earth. The presence of an ionosphere was deduced theoretically, assuming a model atmosphere. Spectral analyses of Jupiter's atmosphere established the presence of hydrogen, methane, and ammonia. Temperature measurements

at various wavelengths showed a fluctuation from 125° K to 200° K in the wavelength range 8 μ to 3 cm, indicating that the thermal emission at different wavelengths comes from different depths in the Jovian atmosphere. Model studies of Jupiter's interior indicated the possible presence of metallic hydrogen and a high density core near the center of the planet. Several parameter measurements of the Jovian magnetosphere or atmosphere at future fly-by missions are suggested. G.G.

N66-15820*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LAUNCH WINDOWS FOR TWO TYPES OF ORBITS SYNCHRONOUS WITH THE LUNAR PERIOD
E. H. Bauer and L. D. Mullins 1 Nov. 1965 48 p refs
(NASA-TM-X-53354) CFSTI: HC $2.00/MF $0.50 CSCL 22C

This report presents launch windows for two types of orbits designed to be synchronous with the lunar orbital period. One class of conic, the 1/8-class orbit, maintains a period one-eighth that of the lunar period an an apogee of approximately one-half the lunar distance. The second type, 1/2-class orbit, consists of a conic with one-half the lunar period and apogee radius approximately equal to the lunar distance, an Arenstorf Orbit. Launch windows are presented which reflect the assumptions and constraints applicable to the specific geometry of each class and to the S-IB/S-IVB/Centaur vehicle. The time period considered for the 1/2-class orbit is December 1967 through June 1968 where only discrete launch opportunities are found. The window for the 1/8-class is less constrained and is shown for each day of any year. Author

N66-15848*# National Aeronautics and Space Administration, Washington, D. C.
HANDLING QUALITIES FOR PILOT CONTROL OF APOLLO LUNAR-LANDING SPACECRAFT
Donald C. Cheatham and Clarke T. Hackler [1964] 40 p refs
Presented at the AIAA/NASA 3d Manned Space Flight Meeting, 4-6 Nov. 1964
(NASA-TM-X-57138) CFSTI: HC $2.00/MF $0.50 CSCL 22A

The lunar landing maneuver is described in sufficient detail to allow appreciation of the control problem, and results of simulation studies aimed at establishing handling qualities data are presented relative to forming a base for a control system design. Consideration is given to such areas as proportional thruster operation, on-off thruster logic operation, and the effect of main engine thrust misalinement. It is reported that results of the studies were applied to the design of a lunar excursion module spacecraft attitude control system which uses, as a primary mode, a system employing a rate command mode having attitude-hold features. Maximum rate command available to the pilot is 20 deg/sec and the rate deadband is equivalent to 0.2 deg/sec. As a backup to the primary mode, the attitude control system can be operated in the direct mode, but the handling qualities are at best acceptable. C.T.C.

N66-15854# Manchester Univ. (England). Dept. of Astronomy.
SPECTROPHOTOMETRIC STUDY OF THE LUNAR SURFACE Final Scientific Report
Zdenek Kopal Jul. 1965 27 p refs
(Contract AF 61(052)-378)
(AFCRL-65-772; AD-623871) CFSTI: HC $2.00/MF $0.50

The report gives an account of the instrumentation (photoelectric spectrometers) built for the study of the luminescence of the lunar surface, as well as of the observations carried out with their aid. The existence of a transient luminescence has repeatedly been detected photoelectrically by the "line-of-depth" method, as well as photographically by use of narrow-passband interference filters in different parts of the lunar surface. The present report gives a summarizing account of such observations. It is pointed out that luminescence is connected with the solar activity, and induced probably by the corpuscular output of solar flares. Author

N66-15902# Princeton Univ., N. J. Dept. of Astronomy.
INVESTIGATIONS OF PROBLEMS OF STAR FORMATION Final Report
Bengt Strömgren 12 Nov. 1965 54 p refs
(Contract Nonr-1858(33))
(AD-623915) CFSTI: HC $3.00/MF $0.50

The research work is concerned with the determination, for F and G stars, of color and absolute magnitude, distance from the galactic plane, space velocity, age, and an index of atmospheric metal content. The instrumentation used for photoelectric photometry is described. A catalogue of 1217 stars brighter than V=6.5 (M), mostly of spectral classes A, F, and G, is also included. TAB

N66-15906# Royal Greenwich Observatory, Herstmonceux (England).
STUDIES OF THE GLOBULAR CLUSTER ω CENTAURI. II: RADIAL VELOCITIES OF BRIGHT MEMBERS
G. A. Harding London, HMSO, 1965 23 p refs *Its* Bull. No. 99 Jointly prepared with the Royal Obs., Cape of Good Hope HMSO: 3s

An account is given of 74 radial-velocity determinations of 40 individual stars with B magnitudes between $10^{m}.71$ and $13^{m}.46$ in the field of the globular cluster ω Centauri. The observations were made with the Cassegrain spectrograph of the Radcliffe 74-inch reflector; most of the plates were taken at 170 A/mm at Hγ, but a few were obtained with a dispersion of 86 A/mm. As the mean radial velocity of the cluster is 238 km/s cluster members are easily identified from their radial velocity and 31 of the 40 stars observed prove to be cluster members. Two of these are blue stars, one of which had already been discovered by Fehrenbach. Multiple observations of 13 cluster members with large rotation moment provide the data for the derivation of the internal rotation and a space-velocity dispersion of 9.8 ±6.6 km/s. The linear velocity of rotation at 10 parsecs from the center is of the same order as the velocity dispersion. Author

N66-15909# Tokyo Astronomical Observatory (Japan).
DATA OF TIME OBSERVATION AND VARIATION OF THE ROTATION SPEED OF THE EARTH
M. Torao, S. Okazaki, and S. Fujii 31 Mar. 1965 15 p refs *Its* Bull. No. 169, 2d Ser.
CFSTI: HC $1.00/MF $0.50

The data of the comparisons between the observed UT and atomic time are given. These data may be available for the miscellaneous studies, such as the variation of the rotation speed of the Earth, the variation of longitude, the movement of the pole and others. The station errors of time determinations for respective observatories were estimated from the data and the seasonal variation of the rotation speed of the Earth was determined from the same data. The result is

$$\Delta S = 22.5^{ms} \sin 2\pi\tau - 7.7^{ms} \cos 2\pi\tau - 6.7^{ms} \sin 4\pi\tau + 6.0^{ms} \cos 4\pi\tau$$

in which τ is the fraction of a year. Author

N66-15910# Tokyo Astronomical Observatory (Japan).
PHOTOGRAPHIC OBSERVATION OF COMETS
H. Hirose, K. Tomita, and H. Kosai 31 Mar. 1965 9 p *Its* Bull. No. 168, 2d Ser.
CFSTI: HC $1.00/MF $0.50

Photographic observations of the comet Ikeya, minor planets, and comets are tabulated. The observations were made from the Kurashiki, Dodaira, and Mitaka stations. E.E.B.

N66-15918# Royal Greenwich Observatory, Herstmonceux (England).
STUDIES OF THE GLOBULAR CLUSTER ω CENTAURI. III: PROPER MOTIONS
C. A. Murray, D. H. P. Jones, and M. P. Candy London, HMSO, 1965 24 p refs *Its* Bull. No. 100
HMSO: 3s

The proper motions which have been published in R.O. Annals No. 2 of over 4000 stars brighter than $B \approx 16^m.8$ in the field of ω Centauri are discussed. A statistical procedure is described for separating cluster members from field stars in a restricted range of colour and magnitude, by means of their proper motions. The proper motion of the cluster has been determined relative to fifteen independent groups of field stars in different ranges of colour and magnitude. The mean parallaxes of the groups of field stars have been derived from the observed dispersions in their proper motions on the assumption that their velocity distributions are similar to those for stars in the solar neighbourhood; this assumption seems to be partially justified since, on the average, the ratio of the axes of the velocity ellipse for most groups is similar to that for nearby stars. The observed numbers of field stars in each magnitude range are compared with van Rhijn's tables. For magnitudes fainter than $B=13^m$ the observed numbers are less than those predicted, the deficiency being about a factor of two for $B=16^m$. The relative precisions of the proper motion of the cluster, corresponding to different magnitude limits, are given, and recommendations are made for the selection of stars for measurement in future investigations of this nature.
Author

N66-15952# Tokyo Astronomical Observatory (Japan).
POLAR TUBE OBSERVATIONS DURING 1964
Naosuke Sekiguchi, Jun'itsu Matsumoto, and Fumiko Nemichi 31 Mar. 1965 2 p *Its* Bull., 2d Ser., No. 170 CFSTI: HC $1.00/MF $0.50

The observational results of the polar tube are tabulated. The computed positions of the instantaneous celestial pole were calculated in Ephemeris Time but the effects of the difference between U.T. and E.T. were negligible. The proper motions of the stars used in these observations were determined however; these values contain some unsatisfactory points. During the course of the computation of the residuals the effects of the proper motions of the stars were not taken into consideration. Accordingly, the residuals contain secular parts caused by the proper motions of the used stars. E.E.B.

N66-15977*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
BASIC STUDIES IN SPACE VEHICLE ATTITUDE CONTROL
Ninth Semiannual Status Report
I. Flügge-Lotz and R. H. Cannon, Jr. Dec. 1965 21 p refs (Grant NsG-133-61)
(NASA-CR-69657) CFSTI: HC $1.00/MF $0.50 CSCL 22A

The studies of the design of control systems which include a human operator and attitude control of a flexible, spinning, toroidal manned space station are reviewed. Also, optimum and suboptimal control of the pitch motion of a satellite in elliptic orbit; the complete attitude control problem for an earth satellite in elliptic orbit; the validity of linearization in attitudes control; random disturbances in control problems; computation of approximately optimal control; rigorous error bounds on position and velocity in satellite orbit theories; and solar perturbation of Mars orbiters are discussed. E.E.B.

N66-15978*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
MISSIONS TO THE COMETS
F. Narin, D. L. Roberts, and P. M. Pierce Dec. 1965 45 p refs (Contract NASr-65(06))
(NASA-CR-69656; M-9) CFSTI: HC $2.00/MF $0.50 CSCL 22A

This report is a digest of six reports covering the general area of preliminary selection and assessment of missions to comets in the years 1965–1986. These reports consider the feasibility of unmanned scientific missions to well-known short-period comets and to new comets. These reports lead to the following conclusions. Opportunities for missions to short-period comets occur at an average rate of one per year; about one in four of these is particularly attractive. If a comet detection network and a quick-response launch facility are available in the future, nearly one new comet mission per year would be feasible. In most cases a launch vehicle of the Atlas-Centaur class would be adequate. For almost all missions the fundamental experiments would be measurements of charged particles, dust, and magnetic field in the comet coma and tail, together with measurements aimed at determining the properties of the comet nucleus.
Author

N66-15993# RAND Corp., Santa Monica, Calif.
BOOK REVIEW: *SPACE PROBES AND PLANETARY EXPLORATION* BY WILLIAM CORLISS
S. M. Greenfield Nov. 1965 4 p Submitted for Publication (P-3269) CFSTI: HC $1.00/MF $0.50

Based on a critical review, it is concluded that the book would be helpful and informative to the well read layman, and would serve adequately as a text for high school level courses in Space Technology. The first part of the book is introductory and describes the philosophy behind the Space Program. The second part concerns itself with space dynamics, communication, data handling, trajectories, guidance, launch vehicles, spacecraft, missions, and techniques. The third and final part devotes itself to instrumentation and scientific experimentation.
D.T.

N66-15998# Royal Greenwich Observatory, Herstmonceux (England).
TIME AND LATITUDE SERVICE 1964, OCTOBER–DECEMBER
R. v. d. R. Woolley London, HMSO, 1965 22 p *Its* Bull. No. 102 HMSO: 3s

Results are given for measurements made at the Herstmonceux observatory, and the activities of the period are reported. The tabulated data included are time and latitude observations, radio time signal reception times, and atomic clock comparisons. For more accurate computation of satellite orbits, the transatlantic travel time of high frequency signals from Beltsville, Maryland, to Herstmonceux was redetermined at 20.6 milliseconds, which yields an effective surface velocity of 287 km/msec for emission at 15 Mc/s. D.T.

N66-16024# Royal Greenwich Observatory, Herstmonceux (England).

STUDIES OF THE GLOBULAR CLUSTER ω CENTAURI. IV: PHOTOMETRY OF RR LYRAE VARIABLES

R. J. Dickens and Jennifer Saunders London, HMSO, 1965 28 p refs Prepared jointly with Roy. Obs., Cape of Good Hope *Its* Bull. No. 101

HMSO: 4 s

Magnitudes in two colors, B and V, are presented for forty-five RR Lyrae variables in ω Centauri. The observed relations between color, amplitude, period and luminosity are discussed and compared with the same relations for M3, based on observations by Roberts and Sandage. Uncertainty in the reddening of ω Centauri precludes an exact comparison with M3 but it appears that the variables in ω Centauri are consistently bluer at a given period than those in M3. Weak period-luminosity correlations are found in ω Centauri which are not present in M3. The variables satisfy the pulsation criterion $P\sqrt{\bar{\rho}}$ = constant within the limits of the data. If the pulsation theory is correct, the observations predict that the absolute magnitude of the variables in ω Centauri is $\sim 0^m.2$ brighter than that of those in M3. Author

N66-16036# Aeronautical Research Associates of Princeton, Inc., N. J.

A STUDY OF TIME-OPTIMAL INTERCEPT IN TWO DIMENSIONS, VOLUME II Final Report, Apr. 1963–Jun. 1964

Bernard H. Paiewonsky and Peter J. Woodrow Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1965 70 p refs

(Contract AF 33(657)-11319)

(ARAP-69, Vol. II; AFFDL-TR-65-20, Vol. II; AD-624219) CFSTI: HC $3.00/MF $0.75

A planar time-optimal formulation is used to study the terminal phase of interception above the atmosphere in a uniform gravitational field. The dependence on initial conditions of the optimal steering angle is examined for initial relative velocities ranging from 5,000 ft/sec to 50,000 ft/sec and initial distances up to 500,000 ft. Results are presented in graphical form for two typical rockets showing: (1) the range dependence of terminal error sensitivities to errors in measurements of initial conditions taken along the initial rectilinear coasting path and (2) the variation in these terminal error coefficients along optimal interception paths. Some interceptions with proportional control systems were made and compared with the optimal paths. Author (TAB)

N66-16051*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MEASUREMENTS OF THE MAGNETIC FIELDS IN INTERPLANETARY SPACE AND THE MAGNETOSPHERE

Norman F. Ness Aug. 1965 58 p refs Presented at the 9th Intern. Conf. on Cosmic Rays, London, 6–17 Sep. 1965 (NASA-TM-X-55352; X-615-65-352) CFSTI: HC $3.00/MF $0.50 CSCL 04A

Direct measurements of magnetic fields in space have been performed by satellites and space probes since 1958. The results of these experiments reveal the continual confinement of the geomagnetic field by the "solar wind", forming the magnetosphere and the Earth's magnetic tail. At 3–6 R_e permanent effects due to "ring currents" have been detected. Enclosing the magnetosphere is a turbulent boundary layer separated from the interplanetary medium by a collisionless MHD shock wave. At the subsolar point the distance to the termination of the regular geomagnetic field is approximately 10 R_e and to the shock wave, 13.4 R_e. The geomagnetic tail is observed out to a distance of 40 R_e trailing away from the sun much in the fashion of cometary tails. The magnetized solar plasma contains a field of approximately 5 gammas which is directed along the classical Archimedean spiral predicted by Parker. The interplanetary field, deduced conclusively to be of solar orgin, is structured into 4 sectors which are readily identifiable during the quiet years of the solar cycle (1963–64). This review summarizes the experiments and their results with respect to our knowledge of fields in space. Author

N66-16081*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

MANUFACTURING CHECKOUT OF ORBITAL OPERATIONAL STAGES Midterm Report, Period Ending 24 Feb. 1965

Frank L. Day, Louis L. Haas, W. T. Scarborough, and R. A. Blais 12 Apr. 1965 139 p refs

(Contract NAS8-11477)

(NASA-CR-69704; LMSC-A746800) CFSTI: HC $4.00/MF $1.00 CSCL 22A

A post manufacturing checkout study on the Saturn S-IVB stage and the Saturn V instrument unit was performed to identify those areas of manufacturing which require changes or additions to accommodate the peculiarities of parking orbit operations. The S-IVB and IU stages were considered as single orbiting systems and recommendations and conclusions were reached by evaluating individual requirements of these stages. The desirability of an actual mating of these stages for simulation of orbital checkout conditions was examined. A major consideration in validating orbital checkout capability involved verification of ground or IU borne computer programs on which decisions to commit the lunar injection are to be used. Orbital checkout parameters should be checked between first and second burns of a multiple burn static firing of the S-IVB mated with a flight IU. G.G.

N66-16082*# Honeywell, Inc., St. Paul, Minn. Research Dept.

RESEARCH AND STUDY IN SYSTEM OPTIMIZATION TECHNIQUES Second Quarterly Progress Report, Feb. 14–May 14, 1965

D. L. Lukes and R. G. Johnson 1 Jun. 1965 10 p *Its* Rept.-1546-QR-2

(Contract NAS8-5222)

(NASA-CR-69712) CFSTI: HC $1.00/MF $0.50 CSCL 22C

A literature survey on methods and techniques for determining regions of stability of motion was made. New results were found for estimates of the domain of attraction for systems of the form $\dot{x} = Ax + R(x)$, where A is a stability matrix and R(x) contains higher order terms. A P-matrix predictive guidance for a three-stage Thor vehicle was evaluated through computer simulation using the guidance sensitivities as a linear combination of the terminal errors driven to zero by steering and cutoff commands. G.G.

N66-16088*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

THEORY OF MINIMUM EFFORT CONTROL

John V. Breakwell, Herbert E. Rauch, and Frank F. Tung Washington, NASA, Jan. 1966 196 p refs

(Contract NAS1-3777)

(NASA-CR-378) CFSTI: HC $5.00/MF $1.25 CSCL 22C

This report is concerned with optimum guidance for interplanetary missions using either a high thrust or a low thrust engine. The guidance problem is formulated as a problem in optimum control theory, and control theory techniques are applied to its solution. The solution is first presented for the case where (1) only one component of the position at the terminal time is to be specified, (2) the information rate histories

are specified in advance, (3) there is negligible engine mechanization error, and (4) the magnitude of the control is linearly related to the predicted miss distance. The solution is then extended to four separate cases, namely, (1) the rms value of more than one terminal component is specified, (2) the information rate histories (i.e., the rate of measurement and the type of observations) are to be optimized, (3) engine mechanization errors are taken into account, and (4) nonlinear feedback is allowed. Author

N66-16146*# National Aeronautics and Space Administration, Washington, D. C.
BRIGHTNESS VARIATION OF THE ECHO I SATELLITE [YESHCHE RAZ OB IZMENENII BLESKA SPUTNIKA 'EKHO-I']
M. V. Bratiychuk and G. V. Moskaleva Dec. 1965 16 p refs Transl. into ENGLISH from Byul. St. Optich. Nablyudeniya Iskusstv. Sputnikov Zemli (USSR), no. 36, 1963 p 23–9
(NASA-TT-F-9841) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Photometric curves of the Echo I satellite obtained photographically are given. A short period of the brightness variation as a function of the configuration of the satellite's reflect-covered. These periods of brightness variation are tabulated for several days falling during the years 1960 to 1963. An attempt is made to explain the nature of the brightness variation as a function of the configuration of the satellite's reflecting surface and the position of its axis of rotation relative to the observer. L.S.

N66-16151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE MARINER II MICROWAVE RADIOMETER EXPERIMENT
Douglas Emron Jones 1 Jan. 1966 73 p refs
(Contract NAS7-100)
(NASA-CR-69916; JPL-TR-32-722) CFSTI: HC $3.00/MF $0.75 CSCL 22A

A dual-channel microwave radiometer obtained three scans across the planet Venus at wavelengths of 13.5 and 19 mm. The relationship of the peak temperature values of the three scans supports a hot-surface model for the planet. Several atmosphere–surface configurations were assumed in an attempt to match the limb-darkening ratios and temperature values measured at both wavelengths. The model that agrees best with the data consists of a specular surface and an isothermal cloud-type layer at a temperature near 350° K. The marked difference between the 13.5- and 19-mm temperatures indicates the presence of an abrupt discontinuity in the microwave spectrum of Venus that cannot be due to uncondensed water vapor and hence requires the presence of a molecule or molecules in the atmosphere of Venus that condense or polymerize into liquid form at $T \geq 350°$ K and exhibit line spectra in the vicinity of 13.5 mm and shorter. Author

N66-16156*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
VELOCITY REQUIREMENTS FOR THE EARTH RETURN PHASE OF PLANETARY MISSIONS
Robert M. Jones and William T. Stephens 29 Dec. 1965 96 p refs
(NASA-TM-X-53375) CFSTI: HC $3.00/MF $0.75 CSCL 22A

Retro characteristic velocity requirements have been calculated for the earth return phase of planetary missions with maximum allowable earth entry velocities. The effects of key independent performance parameters on the characteristic velocity and associated burning time requirements have been investigated for the retro maneuver. The propulsion systems considered were low-energy chemical, high-energy chemical, and solid-core nuclear. Results are presented graphically in parametric form, showing characteristic velocity and burning time as a function of approach hyperbolic excess velocity, maximum allowable entry velocity, thrust-to-weight ratio, specific impulse and entry flight path angle. The allowable earth entry velocity ranges from local parabolic to 18 km/sec. Author

N66-16163*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
THE ELECTROMAGNETIC TORQUES ON SPHERICAL EARTH SATELLITES IN A RAREFIED PARTIALLY IONIZED ATMOSPHERE
Frank Hohl Feb. 1966 66 p refs
(NASA-TR-R-231) CFSTI: HC $3.00/MF $0.75 CSCL 22A

A theoretical investigation has been made of the torques acting, as a result of electromagnetic interaction, on spherical conducting earth satellites. The analysis has been applied to the 41-meter-diameter satellite Echo II which is in a near polar circular orbit. The calculations have yielded quantitative values for the accelerating and the decelerating torques. A probable explanation of the nearly constant spin rate of Echo II for a long period of time is that the eddy-current torque and the induction torque were in balance. Other torques are shown to be negligible in comparison with these two. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N66-15225*# General Dynamics/Convair, San Diego, Calif.
PROJECT FIRE INTEGRATED POST FLIGHT EVALUATION REPORT, FLIGHT NO. II
24 Sep. 1965 180 p ref
(NASA-CR-CR-66000; GDC/BKF65-042) CFSTI: HC $5.00/MF $1.00 CSCL 22B

Data are presented on the flight of the second Project FIRE space vehicle and the operation of its systems and subsystems. Details are given for the launch and coast, acceleration, and reentry phases of the 400 000-foot reentry test point. Mission data are evaluated in terms of reentry support from ship, aircraft, and Ascension Island, and telemetry, radar, optical, and atmospheric sounding data acquired. Performance is considered for the reentry package, velocity package, Antares II A5, guidance system, and launch vehicle. Space vehicle countdown and other preflight activities are mentioned. M.W.R.

N66-15238*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
APPLICATION OF DIGITAL COMPUTER TECHNIQUES TO THE STUDY OF THE IMPACT DYNAMICS OF LUNAR-LANDING VEHICLES
W. C. Walton, Jr., B. J. Durling, and H. W. Leonard [1964] 16 p ref Presented at the 68th Meeting of the Acoust. Soc. of Am., Austin, Tex., 21 Oct. 1964
(NASA-TM-X-59961) CFSTI: HC $1.00/MF $0.50 CSCL 22B

This paper deals with a combined analytical study of the dynamics of lunar-landing vehicles. It outlines the general mathematical model, and the idealizations of the structure and landing surface employed to simplify derivation of the equations of motion in three-dimensional space. Special attention is given to idealization of shock absorbers and the interactions between footpads and the surface. A digital compter program for solution of the equations of motion is discussed. Computed motion time histories are presented which show shock absorber action and vehicle accelerations for a realistic lunar landing vehicle during the landing process from touchdown to rest. Author

N66-15265*# AVCO Corp., Wilmington, Mass. Research and Development Div.
CONCEPTUAL DESIGN STUDIES OF AN ADVANCED MARINER SPACECRAFT. VOLUME I: SUMMARY
28 Oct. 1964 112 p Prepared for JPL
(Contract NAS7-100; JPL-950896)
(NASA-CR-69235; RAD-TR-64-36, Vol. I) CFSTI: HC $4.00/MF $0.75 CSCL 22B

A parametric analysis and conceptual design study of the unmanned flyby bus/lander concept for the scientific investigation of Mars during the 1969 and 1971 launch opportunities is reported. The final configuration concept utilizing a spacecraft launched by an Atlas Centaur vehicles is outlined, and a cost and development program leading to a first advanced Mariner vehicle flight in 1969 is presented. The lander vehicle separates from the flyby bus prior to planet encounter, enters the planetary atmosphere, and descents to the surface on a parachute. Both, flyby bus prior to planet encounter, enters the planetary atmosphere, and descends to the surface on a parachute. Both flyby bus and lander collect interplanetary data, map the planet, and transmit the data to Earth. The sterilized lander vehicle is designed to withstand an impact load of up to 1500 g for a landed payload protected by crushable material. A minimum of three launch attempts evolved as necessary to achieve an 84 percent chance of at least one successful mission during the above named time span. G.G.

N66-15266*# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.
CONCEPTUAL DESIGN STUDIES OF AN ADVANCED MARINER SPACECRAFT. VOLUME II: SYSTEMS ANALYSIS
[1964] 244 p Prepared for JPL
(Contracts NAS7-100; JPL-950896)
(NASA-CR-69236; RAD-TR-64-36, Vol. II) CFSTI: HC $6.00/MF $1.50 CSCL 22B

This systems analysis presents the results of separate mission analyses, trajectory analyses, and payloads studied for the advanced Mariner flyby bus/lander program to be implemented in the scientific exploration of Mars. A factory to launch and mission sequence is included, together with a definition of the anticipated environments to outline the sequential steps throughout the assembly, test, launch, and mission phases of the program. The mission plan indicates the number and type of spacecraft required to attain a reasonable probability of success. Included trajectory data cover departure, transit, approach, encounter, and post encounter parameters with emphasis on launch window selection and flyby bus/lander separation analysis. G.G.

N66-15267*# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.
CONCEPTUAL DESIGN STUDIES OF AN ADVANCED MARINER SPACECRAFT. VOLUME III: LANDER DESIGN
28 Oct. 1964 533 p Prepared for JPL
(Contracts NAS7-100; JPL-950896)
(NASA-CR-69237; RAD-TR-64-36, Vol. III) CFSTI: HC $8.33/MF $2.50 CSCL 22B

A detailed analysis of all pertinent subsystems for a Mars lander design is presented. Evaluated were heat shields, descent systems, impact systems, and communication parameters. Aerodynamic, thermal control, scientific instrumentation, and design considerations were included in the overall design picture. The final conceptual design evolved in a 90-inch diameter Apollo shape able to land an 8.5-lb scientific package on Mars. Its objectives are biological determinations, and pressure, temperature, and wind measurements. Composition of the Mars atmosphere will be observed by a multichannel radiometer during peak heating while on parachute descent. The landed package is a spherical ball with impact attenuation material all over. Inside the sphere is a payload employing a floating system for antenna erection after impact. All subsystems for the lander were evaluated in great detail and are included. G.G.

N66-15268*# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.
CONCEPTUAL DESIGN STUDIES OF AN ADVANCED MARINER SPACECRAFT. VOLUME IV: FLYBY BUS DESIGN
28 Oct. 1964 384 p Prepared for JPL
(Contract NAS7-100; JPL-950896)
(NASA-CR-69238; RAD-TR-64-36, Vol. IV) CFSTI: HC $7.00/MF $2.00 CSCL 22B

Various advanced Mariner flyby/bus design configurations were evaluated for their applicability to a Mars landing. The primary objective was to find a system that does not exceed the static envelope of the Surveyor shroud, and to keep the launch weight of the spacecraft inside the permissible injection capability of an Atlas Centaur booster. Parametric data about significant subsystems were developed and bounding estimates for the size of solar panels, lander, high gain antenna, main propulsion thrust chamber, moments of inertia, and a gimbaled payload platform were formed. Various configurational arrangements were studied from the viewpoint of maximizing the lander dimensions, and a 90-inch diameter lander evolved as the best concept. It was found that this lander could be accommodated if the original 17.25-inch vertical section of the Surveyor shroud was increased by 11 inches. A final reference design layout incorporating the shroud modifications is shown. G.G.

N66-15269*# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.
CONCEPTUAL DESIGN STUDIES OF AN ADVANCED MARINER SPACECRAFT. VOLUME V: DEVELOPMENT PLAN AND COST
28 Oct. 1964 233 p Prepared for JPL
(Contracts NAS7-100; JPL-950896)
(NASA-CR-69239; RAD-TR-64-36, Vol. V) CFSTI: HC $6.00/MF $1.50 CSCL 22B

Development and cost plans for the design of an unmanned flyby bus/lander for scientific investigations of Mars are presented. Development analysis evaluated the preliminary and final system designs, a subsystem development program, system hardware procurement and fabrication, system development and testing, flight hardware procurement and testing, and a sterilization facility. The cost plan indicates the total costs of both, a 1969 and a 1971 launch. Bus development costs were about the same as those for the lander. G.G.

N66-15336*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

MARINER MARS ORBITER STUDY Final Presentation

27 Aug. 1964 84 p Prepared for JPL

(Contracts NAS7-100; JPL-950877)

(NASA-CR-69253) CFSTI: HC $3.00/MF $0.75 CSCL 22B

Details on the Mariner Mars orbiter study are presented in graphic form. The basic requirements are listed, and the objectives and concepts are outlined for the Mars 1969 and 1971, and the Venus 1970 missions. Figures depict the various orbit capabilities, geometries, and dispersions; the separation velocity and entry attitude considerations; and the control and guidance parameters. The experimental instrumentation is listed; the communications ground rules and capabilities are delineated; candidates are nominated for the primary propulsion system; and the structural concepts and selected materials are identified. Weight data are tabulated, program costs are estimated, and mission schedules are included. Schematics on the various systems are presented, and performance characteristics are plotted. M.G.J.

N66-15514# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).

WEATHER SATELLITES: TIROS AND NIMBUS LITERATURE SURVEY

Jun. 1965 74 p refs

(TDCK-42600) CFSTI: HC $3.00/MF $0.75

Abstracts of selected articles dealing with Tiros and Nimbus satellite observations and a review of weather satellite launchings and observational instrumentation are included in a literature survey listed chronologically in four separate sections. The first chapter includes general background information and deals with objectives and capabilities of weather satellites; design, instrumentation, and evolution of the Tiros system; and plans for future developments. A chapter on design and instrumentation considers weather satellites and their systems, optical instrumentation, radiation experiments, ground stations, and data processing. The section on cloud photography and nephanalyses contains abstracts on cloud pattern and structure, satellite observations, synoptic interpretation, and comparisons of Tiros photography with conventional meteorological observations. In the last chapter are reviews dealing with radiation data interpretation and satellite measurements. M.W.R.

N66-15540*# Space Technology Labs., Inc., Redondo Beach, Calif.

STUDY OF UNMANNED SYSTEMS TO EVALUATE THE MARTIAN ENVIRONMENT. VOLUME III: UNMANNED SPACECRAFT DESIGN

Robert L. Sohn and Paul Dergarabedian 23 Sep. 1965 152 p refs

(Contract NAS2-2478)

(NASA-CR-68742; STL-5303-6015-TU-000) CFSTI: HC $5.00/MF $1.00 CSCL 22B

Description of an unmanned spacecraft designed to evaluate the Martian and Cismartian environments in preparation for subsequent manned Mars landing missions is presented. The design concepts include orbiter/bus (or flyby) systems, entry capsules and survivable landers. In addition, a high resolution photo mapper package is defined. Payloads were selected on the basis of detailed requirements analyses reported in prior phases of the present study contract and the launch capabilities of several boost systems were examined to select the most effective Earth boost system for each of the precursor spacecraft. M.R.W.

N66-15543*# Space Technology Labs., Inc., Redondo Beach, Calif.

STUDY OF UNMANNED SYSTEMS TO EVALUATE THE MARTIAN ENVIRONMENT. VOLUME I: SENSITIVITY ANALYSIS

Robert L. Sohn and Paul Dergarabedian 23 Sep. 1965 300 p refs

(Contract NAS2-2478)

(NASA-CR-68740; STL-5303-6013-TU-000) CFSTI: HC $7.00/MF $1.50 CSCL 22B

Results of a study devoted to establishing the sensitivity of the manned Mars system to uncertainties in the Martian and Cismartian environment are presented. These interactions were established by gathering and analyzing available data on the Martian and interplanetary environments, and placing upper and lower bounds upon the environment data in an effort to establish limits on the uncertainties in each environmental factor. A reference manned mission system design was selected based upon a design study conducted previously, and utilizing the Mars orbiting rendezvous mode. Weight scaling laws were available for each of the designs so that the interactions of environmental factors on the system design could be readily evaluated in terms of overall gross weight in the earth parking orbit. M.R.W.

N66-15598*# National Aeronautics and Space Administration, Washington, D. C.

REPORT TO THE SPACE SCIENCE BOARD ON THE SPACE SCIENCE AND APPLICATIONS PROGRAMS

H. E. Newell Dec. 1965 163 p refs

(NASA-TM-X-57113) CFSTI: HC $5.00/MF $1.00 CSCL 22B

A list is presented of the successful major satellite and space probe firings that have been carried out in connection with the NASA program since the creation of NASA in 1958. Investigations and investigators for forthcoming missions of orbiting geophysical observatories, interplanetary explorers, balloons, research aircraft, and sounding rockets are discussed in detail. Also reviewed are lunar and planetary missions, biological satellites, applications technology satelliites to conduct various space environmental investigations, and the manned space science program. Also presented are a summary of NASA launch vehicles and their descriptions, NASA-sponsored research in space-related science and technology by universities and non-profit organizations, and costs of launched spacecraft. R.R.D.

N66-15766*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SATURN V VEHICLE MECHANICAL DESIGN INTEGRATION WORKING GROUP MEETING

J. C. Glover et al 9 Jul. 1963 108 p

(NASA-TM-X-57122; M-P&VE-VA-163-63) CFSTI: HC $2.00/MF $0.50 CSCL 20D

A compilation of presentations given at the Saturn V Vehicle Mechanical Design Integration Working Group Meeting held July 9, 1963 is presented. The purpose is to provide a single source for all vehicle oriented design data for the Saturn V launch vehicle thus assuring compatible, complete, and current information. Areas covered are design criteria, vehicle weights, structures, vehicle pressure distribution and venting requirements, vehicle environmental control requirements, vehicle access requirements and provisions, propellant dispersion ordinance, vehicle alignment and coordinate system, and vehicle interface control. M.R.W.

N66-15774*# Honeywell, Inc., St. Petersburg, Fla. Aeronautical Div.

NASA PATTERN RELEVANCE GUIDE. VOLUME II: CONCEPTS

R. Laurence Day 23 Dec. 1965 214 p refs Revised *Its* Rept.-8-20207-RG, Vol. II
(Contract NAS8-20207)
(NASA-CR-69549) CFSTI: HC $6.00/MF $1.25 CSCL 22B

The NASA/PATTERN tree is a morphological decomposition of a set of potential goals and concepts of the U.S. Space Program specifically designed to permit the assignment of relevance numbers to all elements of the complex (branches of the tree). Forty-six space mission concepts developed in skeletal form to indicate clearly and explicitly the elements of the concept are presented. A concept description is included for each, composed of a brief statement of mission objectives, including some operational considerations, a list of systems comprising the concept, references, and a trajectory description. One primary ground rule used in configuring the concepts was to utilize Apollo technology wherever possible and to assume the Apollo state-of-the-art as the technology base for estimating deficiencies. Three concepts relate to investigation of and utilization of the moon for scientific purposes. A group of nine concepts, both manned and unmanned, and ranging from flyby to fairly long term landing missions, are directed at the two nearest planets to the earth, Mars, and Venus. Four concepts are directed at certain planets farther from earth, Marcurt inward and Saturn outward relative to the Sun. In addition, six concepts are postulated as more general in nature, directed at the solar system in general, the space out of the ecliptic plane, comets, asteroids, etc. M.R.W.

N66-15775*# Honeywell, Inc., St. Petersburg, Fla. Aeronautical Div.
NASA PATTERN RELEVANCE GUIDE. VOLUME III: TECHNOLOGY DOCUMENT
Charles W. Benfield 15 Oct. 1965 483 p refs *Its* Rept.-8-20207-RG, Vol. III
(Contract NAS8-20207)
(NASA-CR-69550) CFSTI: HC $7.83/MF $2.50 CSCL 22B

Information to be used in assigning relevance to elements on the PATTERN relevance tree, a morphological decomposition of a set of potential goals and concepts of the U.S. Space Program, is summarized. These numbers will in turn provide a "yardstick" against which the desirability of various Apollo technology experiments can be estimated. The purpose of this document is to provide minimal background information on the state-of-the-art, and explanatory comments to more clearly define the sometimes cryptic "keyword" abbreviations used to describe technology deficiencies or TDs on the ballots. In some cases the TD represents a critical problem area, but in others it merely represents a need (or desirability) for upgrading present technology in order to better meet the estimated subsystem requirements by the operational date considered. Areas defined are: auxiliary power; data processing; escape and recovery; guidance and navigation; task instrumentation; checkout and maintenance; detection, discrimination, and tracking; propulsion; life support and environmental control; simulation and tracking; vehicle and structure; display; and ground support facility. M.R.W.

N66-15813*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
VOYAGER SPACECRAFT SYSTEM STUDY. PHASE II: SATURN V LAUNCH VEHICLE. VOLUME II Final Report
9 Dec. 1964 377 p Prepared for JPL *Its* Doc.-64SD4376
(Contracts NAS7-100; JPL-950847)
(NASA-CR-69566) CFSTI: HC $7.00/MF $2.00 CSCL 22B

Application of a Saturn V launch vehicle for a Voyager mission to Mars together with basic concepts of Lander and Bus designs, for delivering the Lander to Mars, were evaluated by systems analyses of the various trajectories, guidance requirements, and reliability. The subsystems defined as the gross payload and their effects on the design of a Lander vehicle system were examined. It was found that a Lander with the ballistic coefficient of $W/C_DA = 15$ lb/ft^2 can land about 9600 maximum gross payload on Mars. Bus designs were limited by the shroud dimensions used; bus link calculations and link parameters for five basic configurations are shown. Numerous sterilization-related problems were studied for the selected configurations, and the use of sterilization chambers for smaller Lander vehicles seems promising. Also considered was inclusion of Orbiters as part of the overall Saturn V payload, and a definition of the problems of scientific payload shielding to a radiation level substantially lower than the 10^4 rads used in the basic study. G.G.

N66-15824*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
VOYAGER SPACECRAFT SYSTEM STUDY. PHASE II: SATURN V LAUNCH VEHICLE. VOLUME I: SUMMARY Final Report
9 Dec. 1964 80 p Prepared for JPL *Its* Doc.-64SD4376
(Contracts NAS7-100; JPL-950847)
(NASA-CR-69578) CFSTI: HC $3.00/MF $0.75 CSCL 22B

This summary shows in a parametric fashion how the Saturn V launch vehicle can be used for conducting a Voyager mission. Five scientific payload weights were selected and evaluated for their utilization, together with a basic concept of a Lander vehicle and bus designs for delivering the Lander to Mars. The following was concluded: (1) Restriction of the Lander ballistic coefficient, W/C_DA, to 15 lb/ft^2 or less results in poor utilization of the Saturn V weight capability; (2) about 7300 pounds constitutes the maximum gross payload that can be packaged in a Lander of above dimensions; (3) approximately 9600 pounds is the maximum gross payload that can be landed on Mars by this Lander; (4) design of a Lander for a specific Martian atmosphere results in weight reductions as compared with requirements for a range of atmospheres; (5) an entry corridor of less than 15 degrees is feasible; (6) taking Landers into orbit and then sending them in to Mars improves the scientific payload factor; (7) use of radioisotope thermoelectric generators in a Lander poses serious interface problems; and (8) a blow-out back as alternate impact system shows good promise. G.G.

N66-16017*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
A FEASIBILITY STUDY OF HEAD-END STEERING FOR A SIMPLIFIED MANNED SPACE VEHICLE
George M. Fuller Dec. 1964 228 p refs
(Contract NAS1-4149)
(NASA-CR-66020; SM-48152) CFSTI: HC $5.00/MF $1.50 CSCL 22B

The primary objective of this study was to determine the feasibility of a manned space vehicle concept which would have a wide flexibility of operation, quick response, and launch vehicle simplicity. These goals were achieved by use of an HL-10, high L/D, reusable, spacecraft; fixed nozzle, large solid propellant booster stages; and steering of the launch vehicle from the head end by use of engines mounted within the spacecraft. The concept concentrates the complexity in the manned spacecraft which is reusable over a large number of flights with only minor refurbishment. Author

N66-16080*# Chrysler Corp., Huntsville, Ala. Space Div.
SATURN S-IB STAGE FINAL STATIC TEST REPORT, STAGE S-IB-1

J. V. Wible and R. D. Cox 4 Jun. 1965 161 p refs
(Contract NAS8-4016)
(NASA-CR-69716) CFSTI: HC $5.00/MF $1.00 CSCL 22D

Test data and post-test hardware evaluations from the two acceptance test firings of the Saturn flight stage S-IB-1 are discussed. Overall stage functional performance was acceptable during both tests. Unequal fuel tank ullage pressures were caused by the unbalanced pressure distribution in the fuel tank pressurizing manifold. Engine 7 sustained an internal thrust chamber tube crack which will necessitate its replacement. G.G.

N66-16149*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RANGER VIII AND IX. PART I: MISSION DESCRIPTION AND PERFORMANCE
31 Jan. 1966 132 p refs
(Contract NAS7-100)
(NASA-CR-69914; JPL-TR-32-800) CFSTI: HC $4.00/MF $1.00 CSCL 22B

A technical summary of the mission and performance of the Ranger VIII and IX spacecraft is presented. Discussed are pre-launch and launch operations; the Atlas booster and Agena stage of the launch-vehicle system; various spacecraft subsystems; the deep space network system; the space flight operations system; the flight path; and the camera performance. Spacecraft flight events with reference to nominal mission, predicted, and actual time are listed; and schematic diagrams of the spacecraft configurations and interfaces are depicted. The spacecraft subsystems discussed include the radio, command, telemetry, attitude-control, power, temperature-control, pyrotechnics, midcourse propulsion, and television subsystems. L.S.

N66-16150*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MOTOR-DRIVEN MECHANISMS FOR SPACE FLIGHT APPLICATIONS
E. L. Floyd 15 Feb. 1966 19 p
(Contract NAS7-100)
(NASA-CR-69915; JPL-TR-32-866) CFSTI: HC $1.00/MF $0.50 CSCL 22B

A scanning mechanism was employed on the Mariner II spacecraft to orient the radiometer experiment. A similar device was used to orient the television camera on Mariner IV. These mechanisms were designed to withstand the launch-vehicle boost environment, long storage in the space environment, and operation at planet encounter. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N66-15203# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
TRANSIENT ELASTIC WAVES IN ANISOTROPIC PLATES
Richard A. Scott and Julius Miklowitz Sep. 1965 51 p refs
(Contract Nonr-220(57))
(TR-1; AD-623917) CFSTI: HC $3.00/MF $0.50

For some classes of anisotropic media and certain orientations of the axes of symmetry, plane-strain and torsional motions are possible in elastic plates. Using the linear equations of motion, the solutions to several time-dependent boundary value problems which generate such motions are derived, by menas of multi-integral transform techniques. The problems considered are (1) sudden symmetric application of normal line loads on the surfaces of an infinite plate; (2) sudden application of a normal displacement, together with zero shear stress, at the edge of a semi-infinite plate, whose lateral surfaces are stress-free; (3) sudden application of a normal stress, together with zero lateral displacement, at the edge of a semi-infinite plate, whose lateral surfaces are stress-free and (4) impulsive torsional loading of the surfaces of an infinite plate by means of concentrated torques. In problems (1), (2), and (3), far-field information is obtained by means of a low frequency, small wavenumber approximation, and numerical results are presented for ice, zinc, copper, and several isotropic media for comparison purposes. Author (TAB)

N66-15220# Washington Univ., Seattle. Dept. of Mechanical Engineering.
TRANSIENT ANALYSIS IN A FRACTURING EPOXY PLATE WITH A CENTRAL CRACK
A. S. Kobayashi, W. B. Bradley, and R. A. Selby (Sandia Corp., Livermore, Calif.) 15 Aug. 1965 36 p refs
(Contract Nonr-447(39))
(AD-624168) CFSTI: HC $2.00/MF $0.50

Transient displacement distributions in fracturing epoxy plates were determined experimentally in centrally notched epoxy plates of approximately 16' × 40.2' in size. The Moire fringe method in conjunction with a microflash unit was used to photographically record the transient displacement fields in the fracturing plates. Transient Moire fringe patterns were either scanned by a microdensitometer for accurate determination of the locations of fractional fringes or Westergaard's stress functions were fitted to data points obtained by direct measurements. In most cases, the displacement distributions in the vicinity of the running crack tips varied as $\sqrt{r}$. The dynamic stress intensity factors for cases considered were approximately 2.3 to 5.5 times the static fracture toughness of the material. Distribution of normal strains in the longitudinal direction, of principal strains, and of maximum shear strains were determined for various crack tip locations in the plates. These results showed qualitative agreement between available theoretical and experimental results for comparable solutions. Author (TAB)

N66-15229*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF THE USE OF PENETROMETERS TO DETERMINE THE CAPABILITY OF DUST MATERIALS TO SUPPORT BEARING LOADS
Brantley R. Hanks and John Locke Mc Carty Washington, NASA, Jan. 1966 92 p refs
(NASA-TN-D-3200) CFSTI: HC $3.00/MF $0.75 CSCL 20K

The characteristics of accelerometer-equipped spherical projectiles (penetrometers) impacting targets composed of uniformly sized fine particles were examined under atmospheric pressure conditions over a range of impact variables to determine the adequacy of the penetrometer technique to define the load-supporting capability or bearing strength of dust materials. Acceleration time history of impact and impact craters were studied, and multiple quasi-static loading tests were made to evaluate certain physical properties of the dust targets to define their bearing strengths. The results of this investigation, which was somewhat limited in scope, indicated

that the penetrometer technique is amenable to defining characteristics of a dust material. Peak accelerations and characteristic times of the acceleration time histories generated during penetrometer impact into dust targets are related on a gross scale to the target bearing strength and density. Furthermore, the bearing strength of a dust material depends not only upon the density of the medium but also upon less evident factors such as the size and shape of individual particles. Empirical expressions are formulated for peak acceleration and penetration depth in terms of parameters containing the impact test variables. Author

N66-15249*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FRACTURE MECHANICS OF THROUGH-CRACKED CLYINDRICAL PRESSURE VESSELS

Robert B. Anderson [1965] 26 p refs Presented at the Western Metal Congr., Los Angeles, 22–26 Feb. 1965 Sponsored by the Am. Soc. for Metals

(NASA-TM-X-54980) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The application of fracture mechanics to the design of pressure vessels is discussed with emphasis on the reduction in strength of pressurized cylindrical tanks due to longitudinal through-cracks in the tank wall. The hoop stress at fracture is related to the material fracture toughness, the crack length, and the tank radius. The derived hoop stress at fracture shows good agreement with the data from burst tests of precracked cylinders of 2014-T6 aluminum and ELI 5A1–2.5Sn titanium at −320°F and −423°F. Author

N66-15304 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF ESTIMATION OF FATIGUE STRENGTH WHEN THE PROCESS OF REPEATED LOADING IS DIVIDED INTO TWO STAGES

R. D. Vagapov *In its* Plant Lab. 28 Sep. 1965 15 p refs (See N66-15301 06-34) CFSTI: HC $1.00/MF $0.50

It is proven that for obtaining complete information on strength of materials under fatigue overload a system of combined statistical and functional analysis is required of experimental laws of fatigue when the process of repeated loading is divided into the stage of accumulation of microcracks ending with the formation of a surface crack and the stage of fatigue separation of the body by a large crack. Author

N66-15385*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ADVANTAGES OF MULTIPOINT CONTROL FOR VIBRATION TESTING OF COMPLETE RANGER SPACECRAFT

Jack L. Cooper 1 Jan. 1966 23 p refs

(Contract NAS7-100)

(NASA-CR-69353; JPL-TR-32-847) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Vibration tests performed on early Ranger spacecraft were made using single-point control of the input vibratory accelerations. The results of these tests clearly showed the inadequacies inherent in this method of control for large structures. A six-channel control system was developed and put into use on Ranger Block III spacecraft (Rangers VII–IX). The control system operated in two modes: (1) automatic selection and control on the highest acceleration sensed by any one of the six control accelerometers; (2) control on the square root of the sum of the squares of the acceleration sensed by the six control accelerometers. The results obtained from single-point control demonstrate that the spacecraft input is greatly affected by control point selection. With multipoint control, the input at each mounting point is not controlled perfectly. However, the test requirements are satisfied. Multipoint control also yields a predetermined upper bound that any one mounting point cannot exceed, thus, in effect, holding all the mounting points within a narrower band than could be realized with single-point control. Author

N66-15388*# Technik, Inc., Jericho, N. Y.

HYPERVELOCITY IMPACT—A SERIES SOLUTION. PART II: SPERICAL FLOW

Paul Marnell and Melvin Zaid Jun. 1965 82 p refs

(Contract NAS1-2622)

(NASA-CR-66048; TR-65-16) CFSTI: HC $3.00/MF $0.75 CSCL 20K

The spherical impact of a compressible penetrator and an infinite target is investigated using the infinite series technique previously developed. Ideal fluid behavior is assumed throughout the variable shock flow process and target strength is introduced as a final condition to terminate the crater growth. It is shown that the series solution technique provides a useful means for describing the hydrodynamic phase flow-field during a hypervelocity impact without the necessity of extensive computer codes and calculations. Using simple Hugoniot data to provide the necessary material property data, it is possible to easily calculate the target's spherical flow-field while accounting for continuous energy deposition, variable shock density, and penetrator compressibility. Based on the calculations presented and specific cratering-cessation criterion, the penetration-velocity exponent is 0.56 ±0.03. It appears that simple penetrator energy scaling ($\alpha = 2/3$) or momentum scaling ($\alpha = 1/3$) is not appropriate and that both quantities affect the crater size. E.E.B.

N66-15403*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

A SET OF SIMPLE, ACCURATE EQUATIONS FOR CIRCULAR CYLINDRICAL ELASTIC SHELLS

James G. Simmonds [1964] 43 p refs

(Grant NsG-559)

(NASA-CR-66028) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A new set of equations for the linear behavior of elastically isotropic, constant thickness, circular cylindrical shells subject to edge and surface loads is proposed. The final form of the equations consists of a single, non-homogeneous, fourth order partial differential equation for a complex-valued displacement-stress function together with auxiliary equations for calculating all necessary quantities. The new equations are both concise and adequate in that they comprise a consistent first approximation theory as defined by Koiter. They are compared with previously proposed cylindrical shell equations and are shown to have special advantages while carefully avoiding certain inadequacies of the previous equations. Author

N66-15419*# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

TORSIONAL INSTABILITY OF CANTILEVERED BARS SUBJECTED TO NONCONSERVATIVE LOADING

S. Nemat-Nasser and G. Herrmann [1964] 25 p refs Submitted for Publication

(Grant NsG-605)

(NASA-CR-57217) CFSTI: HC $1.00/MF $0.50 CSCL 20K

A cantilevered bar of uniform cross-section and subjected at the free end to distributed, nonconservative, compressive loads is considered. It is shown that for certain cross-sections

stability may be lost by either torsional divergence (torsional buckling) or torsional flutter, depending upon the load distribution at the end section. In addition, transverse flutter can also occur. It is also indicated how such systems may be realized by means of pipes conveying fluid. Author

N66-15423*# California Univ., Berkeley. Inst. of Engineering Research.

EDGE DISTURBANCES IN AXISYMMETRICAL SHELLS OF REVOLUTION

E. P. Popov and Z. A. Lu Sep. 1964 18 p refs Submitted for Publication

(Grant NsG-274-62)

(NASA-CR-60321; SESM-64-3) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Stress-resultants along meridians for several selected axisymmetrical shells of revolution loaded symmetrically along free edges or with own weight are reported. The shells considered include the ones with zero, positive as well as negative Gaussian curvatures. The solutions are based on bending theory of thin shells. The numerical results were obtained by applying finite element solution using digital computer. Report of solutions for shells of negative Gaussian curvature appears to be novel. Author

N66-15442*# Lehigh Univ., Bethlehem, Pa. Inst. of Research.

EFFECT OF SPACEWISE VARIATIONS IN A RANDOM LOAD FIELD ON THE RESPONSE OF A LINEAR SYSTEM

Ferdinard P. Beer and Robert J. Ravera 1 Aug. 1965 25 p refs

(Grant NsG-466)

(NASA-CR-69386) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Spacewise variations in a random load field are often neglected in computing the statistical properties of the dynamic response of a structure to that field. A method is given for determining whether such an approximation is conservative or not, and for computing the correction which should be used to take into account the spacewise variations in the input field. The proposed method is based on the determination of the response of the structure to a few simple deterministic loadings and does not require the use of multidimensional power spectral analysis. It yields a corrected value for the power spectral density of the response, from which values may be obtained for the mean square of the response, as well as for other of its statistical characteristics. Author

N66-15468# Lockheed Missiles and Space Co., Sunnyvale, Calif.

APPROXIMATE DETERMINATION OF THE CRITICAL FORCES OF SOME ELASTIC SYSTEMS

V. S. Gumeniuk and V. S. Kravchuk [1965] 3 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 10, 1965 p 1295–1297

A simplified method is presented for finding the eigenvalues of some elastic systems whose loss of stability mode is symmetric and which contain a large quantity of half-waves. The method is used to solve the problem of stability of a thin isotropic cylindrical shell, compressed along the axis by a uniformly distributed loading. The stability differential equations are derived, and it is assumed that a sinusoid, relative to the initial position of the middle surface of the shell, is generated in the direction of the x and y axes after the loss of stability. If the number of waves is large enough, the origin may be placed at a two-wavelength distance from the edge, thereby eliminating the use of boundary conditions in writing the equations by finite difference methods. If the net spacing is taken as equal to a quarter wavelength, part of the points will lie at the vertices of the waves and have extremal values; other points of the net will lie at the nodes of the waves, and the values of the deflections at these points will be zero. Examples are given. M.G.J.

N66-15480*# Arizona State Univ., Tempe. College of Engineering Sciences.

INVESTIGATION OF DYNAMIC BEHAVIOR OF THINSPHERICAL SHELLS Semiannual Technical Progress Report, Jun. 1–Nov. 30, 1965

James P. Avery 9 Dec. 1965 22 p refs

(Grant NGR-03-001-013)

(NASA-CR-69400) CFSTI: HC $1.00/MF $0.50 CSCL 20K

A formulation of the general spherical shell vibration problem is presented. The vibration problem is first replaced by an equivalent static problem. The inertial loading of the dynamic problem is replaced by a distributed static load proportional to the displacement. Additionally, an artifice of an elastic foundation is introduced in the static problem such that the foundation reaction is proportional to the displacement vector but in the opposite sense. The equivalent static problem is next formulated in terms of fundamental influence functions. The development of a solution of the fundamental problem which provides the basis for the solution of the general boundary value problem is also discussed. E.E.B.

N66-15484*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Alabama.

A NEW APPROACH TO THE EXPLANATION OF THE FLUTTER MECHANISM

Mario H. Rheinfurth and Frederick W. Swift Washington, NASA, Jan. 1966 31 p refs

(NASA-TN-D-3125) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The paper demonstrates the feasibility and effectiveness of analyzing the stability behavior of a simplified bending-torsion flutter model by the root-locus method of W. R. Evans. This method promotes an intuitive physical interpretation of the flutter mechanism by exposing its intrinsic feedback principle, and lends itself to a systematic and complete classification of the stability patterns of the system by enumerating all possible pole-zero constellations in the complex plane. Results of corresponding conventional studies using Routh-Hurwitz stability criteria are quickly verified and extended. The inclusion of structural damping in the analysis sheds new light on long standing questions about the effect of energy dissipation on system stability and reveals its extreme sensitivity to damping parameter variations. The paper concludes with a discussion of the potentials and limitations of the root-locus method for preliminary design studies and flutter analyses of systems with many degrees of freedom. Author

N66-15493*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

EXPERIMENTAL INVESTIGATION OF THERMAL-BUCKLING CHARACTERISTICS OF FLANGED, THIN-SHELL LEADING EDGES

Jerald M. Jenkins and Walter J. Sefic Washington, NASA, Jan. 1966 31 p refs

(NASA-TN-D-3243) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The thermal-buckling behavior of a wide range of flanged, thin-shell leading-edge specimens was investigated. Specimens of varying geometry were subjected to temperature-rise rates up to 50° F per sec and maximum heating rates up to 19.6 Btu/ft^2-sec. The specimens investigated were constructed of 2024-T3 aluminum, SAE 4130 steel, or Inconel

X-750. Regions of stable structural behavior were established on the basis of leading-edge dimensional and thermal-load parameters. Two types of buckling were observed in the flanges of most of the specimens. The results of the experiments provide thermal-buckling information from which a variety of flanged, thin-shell leading-edge geometries may be selected that are free of unstable structural behavior while under the influence of severe thermal loadings. Author

N66-15494*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORETICAL ELASTIC MISMATCH STRESSES
Robert H. Johns Washington, NASA, Jan. 1966 25 p refs (NASA-TN-D-3254) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Stress-magnification factors were obtained for the effect of mismatch of the middle surfaces at junctions in shell structures. The results are directly applicable only when the thickness and the slope on one side of a mismatched joint are the same as those on the other. Results are found for biaxial stress states with any principal stress ratio at the joint, including cases in which the stresses are of opposite sign. Both principle and effective stress-magnification factors are given for long or local mismatch. The results are presented both graphically and in equation form. As expected, the increase in stress is substantially higher when the membrane stress normal to the mismatch is greater in magnitude than that parallel to the mismatch. The effective stress factors are highest when the membrane stress normal to the mismatch is about twice the membrane stress parallel to the mismatch. This case would occur, for example, at a longitudinal seam in a cylindrical pressure vessel. Principal stress-magnification factors for a given amount of mismatch do not vary with stress ratio if the membrane stress normal to the mismatch is greater than that parallel to the mismatch. Author

N66-15507# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CYLINDRICAL SHELL UNDER THE EFFECT OF A CONCENTRATED RADIAL LOADING
S. K. Perederii [1965] 10 p refs Transl. into ENGLISH from Prikl. Mekhan. (USSR), v. 1, no. 9, 1965 p 14–19

An approach to the solution of shell-theory problems is indicated by the example of a cylindrical shell subjected to the effect of concentrated radial loading. The crux of this approach consists of the utilization of the broad possibilities of double trigonometric series for the representation of the elastic surface loading, and the application of gamma functions to the summation of the series determining the solution. The desired solution is hereby represented in the form of finite expressions or of single trigonometric series, after which it is comparatively simple to obtain the necessary numerical information. Results of computations and experiments are presented. Author

N66-15513# Lockheed Missiles and Space Co., Sunnyvale, Calif.
VIBRATIONS OF A GAS-FILLED CYLINDRICAL SHELL
K. K. Livanov [1965] 10 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 5, no. 5, 1965 p 996–999

When shell mass is much greater than the gas filler's mass, the frequency equation of the combined vibrations of the shell and the gas is approximately equal to the frequency equations for the natural vibrations of both a gas in an absolutely stiff cylinder and the cylindrical shell itself. Analysis indicates that if a gas-filled cylindrical shell is considerably heavier than the gas which fills it, then the vibrations of the gas filler may be neglected and the gas may be regarded as an inertialess medium with constant pressure. A method to account for internal pressure forces is discussed, and it is shown that the axial stress is due to the effect of the internal pressure on the bottom of the shell. The frequency equation is then written as a bicubic in the semidimensional frequency, which changes substantially as the internal pressure grows. The number of circumferential waves corresponding to the minimum frequency diminishes with pressure growth; therefore, the mode of shell vibrations corresponding to the lowest frequency depends on the internal pressure. M.W.R.

N66-15518# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ANALYSIS OF SHORT CYLINDRICAL SHELLS OF VARIABLE WALL THICKNESS
W. E. Jahsman and O. Hoffman [1965] 19 p refs (LMSC-6-75-65-55)

Transfer matrices are developed relating stress resultants, moments, displacements, and rotations at the two ends of a short cylindrical shell with variable wall thickness. The matrix elements are derived through Taylor's expansions for the variables (including the wall thickness variation) and may be made as accurate as desired by retaining additional terms in the expansion. Influence coefficient expressions are derived and compared with results obtained previously for cylinders with constant and parabolic wall thicknesses. Good agreement is found in all cases. The transfer matrices appear to have particular merit for use with computer programs which require excessive run time or suffer from numerical instabilities when wall variation is rapid. Author

N66-15556# Joint Publications Research Service, Washington, D. C.
INDUCED VIBRATIONS OF SHIP'S PLATES UNDER THE EFFECT OF THE HYDRODYNAMIC PRESSURES CAUSED BY SCREW PROPELLERS IN OPERATION
G. I. Fedenko 27 Dec. 1965 11 p refs Transl. into ENGLISH from Sudostroyeniye (Leningrad), no. 7, Jul. 1965 p 15–17
(JPRS-33476; TT-65-34050) CFSTI: $1.00

A method for estimating the vibration resistance of ship hull plates under the effect of hydrodynamic pressure caused by the operation of screw propellers is presented. The method is based on the solution of a nonlinear problem of the forced oscillations of plates of finite stiffness. R.N.A.

N66-15588*# California Univ., Berkeley.
STRESSES AND DEFORMATIONS IN THIN SHELLS OF REVOLUTION Seventh Progress Report
E. P. Popov and J. Penzien 30 Dec. 1965 18 p refs Submitted for Publication
(Grant NsG-274)
(NASA-CR-69436) CFSTI: HC $1.00/MF $0.50 CSCL 20K

For shells of revolution, finite elements in the form of conical frustra joined at nodal circles were found to be very effective in the solution of problems . An outline of a solution based on these concepts for axisymmetrical response to dynamic loads is given in this discussion. Two examples are included. Excellent agreement between the two solutions is found which serves to corroborate the results found independently. The other example shows a possible advantage of the method described here in some problems. Author

N66-15594*# Bolt, Beranek, and Newman, Inc., Los Angeles, Calif.

A WIND TUNNEL INVESTIGATION OF PANEL RESPONSE TO BOUNDARY LAYER PRESSURE FLUCTUATIONS AT MACH 1.4 AND MACH 3.5

David Alan Bies Oct. 1965 90 p refs Prepared for Douglas Aircraft Co., Santa Monica, Calif. *Its* Rept.-1264
(Contract NASw-932)
(NASA-CR-69444) CFSTI: HC $3.00/MF $0.75 CSCL 20K

Two test panels were designed and fabricated to measure panel response to boundary layer pressure fluctuations in the frequency range of high modal density. The response of these panels to a turbulent boundary layer under conditions of unperturbed and mildly perturbed flow at Mach 1.4 and 3.5 was measured. The response of test panels to everberant acoustic fields was also measured. The following represent some of the conclusions obtained from the results of the experiment: (1) Fairly good quantitative agreement was obtained between theoretically predicted and measured panel response to turbulent boundary layer pressure fluctuations for the cases of unperturbed flow. Correlation investigation of panel acceleration response yields resulted in qualitative agreement with theory, which predicts the existence of surface Mach waves. (2) To a fair approximation, one may associate a single transfer function with a panel which will relate acceleration response to turbulent boundary layer pressure fluctuations under conditions of unperturbed or mildly perturbed flow. (3) The clamped panel may offer a better means of investigating the boundary layer pressure fluctuation field. (4) Model studies, such as considered in this investigation, offer valid means for predicting full-scale response. R.R.D.

N66-15617*# TRW Systems, Redondo Beach, Calif. Physical Electronics Lab.

PENETRATION OF THIN FILMS BY HYPERVELOCITY MICROPARTICLES

J. F. Friichtenicht Jul. 1965 9 p refs
(Contract NASw-936)
(NASA-CR-69481; STL-4158-6013-TU-000) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Films typical of those flown aboard the Explorer VII satellite were calibrated using high-speed particles from the electrostatic hypervelocity accelerator. The thin film, in the form of a strip about one inch wide by three inches long, was mounted in a test fixture attached to the end of the accelerator drift tube. A detector for the measurement of particle charge, velocity, mass, and trajectory was positioned immediately in front of the film holder. The targets were 0.00025-inch thick mylar films with a thin layer of vapor-deposited aluminum on the impact side. The diameters of the holes were measured with a screw micrometer eyepiece and a high power optical microscope. The results which are summarized show that the ratio of hole diameter to particle diameter increases slowly with velocity but is relatively constant from about 5 of 6 km/sec and up. The scatter of the data prohibited a reasonable estimate of the velocity dependence. The lack of precision arises from errors in the measurements. The hole diameter is at most one or two times the particle diameter even at the highest impact velocities. E.E.B.

N66-15639*# Harvard Univ., Cambridge, Mass.

DYNAMIC BUCKLING ESTIMATES

John W. Hutchinson and Bernard Budiansky [1964] 22 p refs
(Grant NsG-559)
(NASA-CR-66030) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Attention is focused on the dynamic buckling of imperfection-sensitive models subjected to loading histories characterized by a finite length of time of load application. Results are presented which show that for all but highly imperfect structures the finite-time buckling impulse can be considerably less than the zero-time buckling impulse. The application of the results obtained from the models to actual imperfection-sensitive structures is discussed and results are obtained which suggest what would seem to be conservative buckling estimates for a long cylindrical shell loaded in axial compression and having sufficiently strong end restraints. Author

N66-15646# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

THE INTERIOR ELASTIC STRESS FIELD IN A CONTINUOUS, CLOSE-PACKED FILAMENTARY COMPOSITE MATERIAL UNDER UNIAXIAL TENSION

Henry R. Piehler Jun. 1965 42 p refs
(Contract AF 49(638)-1463)
(ASRL-TR-132-1; AFOSR-65-1426; AD-624572) CFSTI: HC $2.00/MF $0.50

Using symmetry arguments, boundary conditions are established which must hold on the lines of symmetry between neighboring filaments in an oriented filamentary composite. These conditions serve to set the problem as a special case of the mixed boundary value problem of elasticity. The composite is assumed to deform such that the normal strains in the direction of the filament axes are the same in both media. The equations of elasticity are then solved in polar coordinates so that the solution has the appropriate sixfold symmetry. The in-plane stresses are vanishingly small for the epoxy-fiberglass composite. For the silver-steel composite, the in-plane stresses reach about three percent of the average axial stress. When the filaments are close together, the periodic portions of the stress field are most important. As the filaments are more widely spaced, the stress field becomes more circularly symmetric. The phasing of the stress field is such that the radial stress is compressive at the point where the filaments are closest together and tensile at the point where the filaments are farthest apart. In all cases, the composite Young's modulus varies linearly with filament fraction. TAB

N66-15653# Naval Research Lab., Washington, D. C. Mechanics Div.

CHARACTERISTIC DYNAMIC STRENGTH RATIO AS THE LIMITING PARAMETER IN SHOCK DESIGN Interim Report

Henry C. Mayo 2 Nov. 1965 42 p refs
(NRL-6363; AD-624438) CFSTI: HC $2.00/MF $0.50

The dynamic strength ratio of a structure is defined as the ratio of the dynamic yield strength (a number determined by multiplying the static yield strength times a dynamic loading factor) of the structural material to the maximum fiber stress in the structure when it is subject to the acceleration of gravity alone (one g). Dynamic strength ratios for bending and buckling are derived and plotted versus frequency for three types of beams, respectively modeled as single degree of freedom systems. The strength ratio plots are superimposed on sample shock spectra to illustrate which regions of the spectra are appropriate for the design of each type of beam. This

comparison of the strength ratio curves and the shock spectra indicates that a specific shock spectrum amplitude is suitable for the elastic design of a given type of structure only if the dynamic strength ratio is greater than or equal to the spectrum amplitude. Author

N66-15665# AVCO Corp., Wilmington, Mass. Research and Advance Development Div.

MEASUREMENT OF THE GRUENEISEN PARAMETER AND THE INTERNAL ENERGY DEPENDENCE OF THE SOLID EQUATION OF STATE FOR ALUMINUM AND TEFLON

D. T. Morgan, M. Rockowitz, and A. L. Atkinson Kirtland AFB, N. Mex., AF Weapons Lab., Oct. 1965 131 p refs

(Contract AF 29(601)-6394)

(AVCO-RAD-TR-65-24; AFWL-TR-65-117; AD-624320) CFSTI: HC $4.00/MF $0.75

Experimental measurements of the solid state equation of state of aluminum and Teflon, including the internal energy dependence, were made. The data for aluminum mesh well with the data of other investigators. Using the aluminum data, it was found that for initial aluminum densities of 1.36, 1.60, and 1.82 gms/cc, the thermal internal energy, E_{th}, is dependent only on the product VP_{th} where V is the specific volume and P_{th} is the thermal pressure. The Grueneisen parameter was found to be given by $100/(39.9 + 0\ 0.284\ VP_{th})$ with VP_{th} in (cm^3 kilobars)/gm. At $VP_{th} = 0$, the Grueneisen parameter = 2.5. The solid Hugoniot for Teflon was found to mesh well with lower pressure measurements by other investigators. The scatter in the porous Teflon samples was too large and the data were too limited to permit evaluation of the Grueneisen parameter. Author (TAB)

N66-15675# Advisory Group for Aeronautical Research and Development, Paris (France).

MANUAL OF AEROELASTICITY, VOLUME 3. THIRD PART: THE FORECAST OF AEROELASTIC PHENOMENA [MANUEL D'AEROELASTICITE, VOLUME 3. TROISIEME PARTIE: LA PREVISION DES PHENOMENES AEROELASTIQUES]

W. P. Jones, ed. (Natl. Phys. Lab.) [1960] 341 p refs In FRENCH CFSTI: HC $7.00/MF $1.75

Prediction of aeroelastic phenomena is treated in a seven-chapter manual. Aeroelastic theory is discussed and compared with experimental findings in an introductory chapter. Methods of analysis, sources of information, and flight and elated experiments are reviewed for static aeroelasticity; and resultant loss in guidance effectiveness is considered. Forecasting of flutter and dynamic response are discussed, with equations developed in each instance. Diagnosis and treatment of problems resulting from various kinds of vibration are also reviewed. Another chapter deals with a general study of the dynamic stability of systems with a great deal of freedom; and theories and experimental results related to panel flutter are considered.

Transl. by M.W.R.

N66-15684*# Harvard Univ., Cambridge, Mass.

BUCKLING OF IMPERFECT CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION AND EXTERNAL PRESSURE

John Hutchinson [1965] 17 p refs

(Grant NsG-559)

(NASA-CR-66029; SM-2) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The results of an investigation of the effect of axisymmetric initial imperfections on the buckling of cylindrical shells under combinations of axial compression and pressure are presented and discussed. Interaction curves are obtained which have a branch determined by the present theory and a branch determined by linear buckling theory. Agreement between theory and experiment is quite good. Author

N66-15713# Applied Technology Associates, Inc., Ramsey, N. J.

THE EFFECT OF STRUCTURAL DAMPING ON THE ACOUSTICAL FIELD SURROUNDING A SUBMERGED VIBRATING SANDWICH SHELL

I. W. Jones and V. L. Salerno Sep. 1965 38 p refs

(Contract Nonr-4674(00))

(ATA-106; AD-624442) CFSTI: HC $2.00/MF $0.50

This report utilizes the damped sandwich shell theory developed by the authors in a previous paper as a basis for a study of the behavior of a damped sandwich cylinder vibrating symmetrically while submerged in an infinite fluid medium. The influences of 'added mass' and hydrodynamic damping as well as structural damping on both the radial motion of the shell and, more importantly, on the sound pressure level in the medium are included in the equations. These phenomena are then examined quantitatively in numerical examples. It is shown that the pressure in the medium due to vibration in axisymmetric modes can be reduced by the use of a damped sandwich shell rather than a homogeneous shell of the same weight. Author (TAB)

N66-15826*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SATURN S-I-10 STATIC TEST VIBRATION AND ACOUSTIC DATA

11 Jan. 1966 112 p

(NASA-TM-X-53377) CFSTI: HC $4.00/MF $0.75 CSCL 20K

This report contains a synopsis of the vibration and acoustic data obtained from the static tests of Saturn vehicle S-I-10. The data is presented in terms of acceleration versus frequency, sound pressure level versus frequency, and statistical profiles. These presentations establish the statistical deviation of abnormal environmental parameters measured during static testing. Author

N66-15829*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ELASTIC STABILITY OF A SLENDER BAR WITH FREE-FREE ENDS UNDER DYNAMIC LOADS

Frank C. Liu 10 Dec. 1965 32 p refs

(NASA-TM-X-53367) CFSTI: HC $2.00/MF $0.50 CSCL 20K

Problems of elastic stability of a space rocket under dynamic, nonconservative loads are presented. The spacecraft is treated as a slender, uniform cylindrical bar with free-free ends. Analysis of the frequency of the transverse vibration coupled with longitudinal vibration under the action of time-varying thrust force based on Galerkin's method leads to Mathieu's equation. The elastic stability boundaries of the frequency ratio, longitudinal to transverse, versus the thrust are obtained. The dynamic buckling thrust of a uniform bar with various boundary conditions is presented. The aerodynamic force induced from the oscillation of the rocket in supersonic speed on the critical thrust is investigated. A numerical illustration is given to show the relationship of the critical thrust versus flight speed at various flight altitudes. Author

N66-15847*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SOME RESEARCH RELATED TO THE STRUCTURAL DYNAMICS OF LAUNCH VEHICLES

Harry L. Runyan [1965] 30 p refs Presented at the 6th Intern. Symp. on Space Technol. and Sci., Tokyo, 29 Nov.–4 Dec. 1965
(NASA-TM-X-57131) CFSTI: HC $2.00/MF $0.50 CSCL 20K

This paper treats recent advances in the use of dynamic models for structural dynamics and aeroelastic structures. Specifically, model tests of the Saturn I are discussed as well as tests of the 1/10- and 1/40-scaled models of the Saturn V. The problem of the effect of ground winds on launch vehicles is discussed, including a description of the model program and the results of some tests. Also, the problem of the high-frequency buffet response of a launch vehicle adapter is treated, including a comparison of flight measurement with calculations. Author

N66-15850# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SOLAR DIFFERENTIAL HEATING OF THIN WALL BOOMS IN NEAR EARTH ORBIT
J. E. Kummerer 1 Apr. 1964 34 p refs
(Contract NOw-62-0604-c)
(CF-3073; AD-622486) CFSTI: HC $2.00/MF $0.50

Thin walled cylinders exposed to sunlight in space can develop a relatively large circumferential temperature gradient, which in turn gives rise to relatively large thermoelastic stresses in the cylinder wall. A proposed Radio Astronomy Satellite would use an extendable boom of 1000 feet in length, erected by unwinding a reel of preformed Beryllium copper tape, as an antenna. A relatively large circumferential temperature gradient will produce elongations which, acting over this 1000 foot length, can produce very large end deflections. Before any rigorous structural analysis can be undertaken, a thorough knowledge of the temperature gradients to be expected for the various configurations under consideration is necessary. This report presents the analysis and results obtained to date, of thin walled cylinders in near earth orbit. TAB

N66-15882# National Aerospace Lab., Tokyo (Japan).
QUALITATIVE EXAMINATIONS ON THE RESULTS OF GROUND VIBRATION TESTS OF TAIL WING–FUSELAGE COMBINATION STRUCTURE
Taketoshi Hanawa and Shinichi Koshide 1965 30 p refs in JAPANESE; ENGLISH summary
(NAL-TR-88) CFSTI: HC $2.00/MF $0.50

Some experiments on the vibration of a flight vehicle were carried out to determine the natural frequencies and normal vibration modes. Through these experiments we found the following two unpredicted results: (a) lower natural frequencies of the tail plane than that estimated by the simple analysis, (b) more complicated vibration modes of the fuselage than that predicted. Qualitative examinations show that the decrease of the frequencies of the tail plane are due to the loosing of the boundary condition, $\delta w/\delta y = 0$ for the fixed edge, and the complicated vibration modes of the fuselage are due to the coupling with the system of the inner construction. Besides these examinations some suggestive analysis for this structure are shown. Autho

N66-15933# David Taylor Model Basin, Washington, D. C.
EXCITATION OF SIMPLE STRUCTURES WITH SMALL ROCKET MOTORS
John G. Viner Oct. 1965 52 p refs
(DTMB-2021; AD-623898) CFSTI: HC $3.00/MF $0.50

Small rocket units were fired on a test beam in air and for the first time under water. Natural frequencies, mode shapes, and modal damping values were obtained from the resultant transient data. Steady-state tests were made on the test beam to provide a means of evaluating the results of the rocket tests. Natural frequencies obtained from the rocket tests agreed with steady-state test results within 6 percent. Relative amplitudes between accelerometers at the same filtered frequency obtained from the rocket tests and the steadystate tests were in good agreement. These tests are the first results of a program to investigate the feasibility of using impulsive excitation to determine the vibratory characteristics of naval structures. Further developmental work is required to overcome difficulties experienced in these tests and to develop techniques to identify the vibratory characteristics of larger and more complex structures. Author (TAB)

N66-15972*# AVCO Corp., Nashville, Tenn. Aerospace Structures Div.
ULTRA LIGHT HONEYCOMB DEVELOPMENT FOR S-II STAGE IMPROVEMENT Final Report
P. E. Pigue 19 Oct. 1965 129 p refs
(Contract NAS8-11807)
(NASA-CR-69651; R-1050) CFSTI: HC $4.00/MF $1.00 CSCL 20K

The ultra light honeycomb program has determined that it is feasible to manufacture large, deep core sandwich construction panels. A modified bonding system for titanium was developed in an independent research program and successfully used in the ultra light honeycomb program. Data has been obtained from tests to verify and extend existing data to include deep core sandwich construction. This data is core shear strength, core shear modulus, and proportional limit shear stress. Analysis has shown that for the specimens to be tested in edgewise compression, face wrinkling is the critical mode of failure. An analytical method to determine the ultimate compressive strength for local face wrinkling failure has been determined which closely predicts the failing stress. A weight analysis shows that the approximate weight of the skirt structure of the S-II stage of the Saturn V missile, made of deep core aluminum honeycomb with titanium skins, is 3048 lb. with an ultimate load carrying capacity of 9275 lb/inch of circumference. Author

N66-15992# Hiller Aircraft Corp., Palo Alto, Calif.
HEAVY-LIFT TIP TURBOJET ROTOR SYSTEM. VOLUME IV: STATIC AND DYNAMIC LOADS
Ft. Eustis, Va., Army Aviation Mater. Labs., Oct. 1965 117 p refs *Its* Eng. Rept.-64-44
(Contract DA-44-177-AMC-25(T))
(USAAVLABS-TR-64-68D; AD-624763) CFSTI: HC $4.00/MF $0.75

The report presents the structural design criteria, static design loads, and dynamic design loads for the Model 1108 helicopter. The volume is the basis for the structural design and analysis of the tip turbo jet main rotor system.
Author (TAB)

N66-16055*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
BLAST EFFECTS ON SPACE VEHICLE STRUCTURES
Reino Niemi and Richard Rabenau Washington, NASA, Feb. 1966 67 p refs
(NASA-TN-D-2945) CFSTI: HC $3.00/MF $0.75 CSCL 20K

The purpose of participating in the explosive test was to obtain blast overpressure data, structural response data and to evaluate effectiveness of typical flight instrumentation for measuring blast effects. Data were obtained on pressure loading of a structure as well as response of the structure to the loading. The different types of gages utilized in the test were strain

gages, piezoelectric microphones, strain gage pressure transducers and piezoelectric accelerometers. All gages except the strain gage pressure transducers were partially or wholly effective in measuring blast and structural response parameters. Author

N66-16059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRESS-INTENSITY FACTORS BY BOUNDARY COLLOCATION FOR SINGLE-EDGE-NOTCH SPECIMENS SUBJECT TO SPLITTING FORCES
Bernard Gross and John E. Srawley Washington, NASA, Feb. 1966 12 p refs
(NASA-TN-D-3295) CFSTI: HC $1.00/MF $0.50 CSCL 20P

A boundary-value-collocation procedure was applied in conjunction with the Williams stress function to determine values of the stress-intensity factor K_I for single-edge cracks in plate specimens subject to splitting forces applied close to the crack and acting transversely to it. The results are presented in terms of the dimensionless quantity $Y = K_I BH^{3/2}/Pa$, where B and H are the specimen thickness and half-depth, a is the effective crack length, and P is the applied load. The results are practically independent of the ratio of effective specimen length to specimen half-depth q/H, when this ratio is not less than a/H+2, and are then in excellent agreement with those derived by other investigators from compliance measurements. In the limit, as H/a approaches zero, the value of Y approaches that obtained in an elementary analysis which treats the specimen as a pair of built-in cantilever beams. Author

N66-16064# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
FINITE DEFLECTIONS OF A UNIFORMLY LOADED STEPPED PLATE
Allan B. Pifko and Gabriel Isakson Sep. 1964 39 p refs
(RM-243)

Relative to flat stiffened panels subjected to resultant uniform lateral pressure such as might be used as structural components of aircraft or space vehicles, consideration is given to a long, stepped, rectangular plate which represents the portion of the panel between stiffeners. In order to simplify the analysis, it is assumed that the stiffener spacing is small compared with the length of the panel. Consequently, the problem is idealized to that of a strip of infinite length but finite width. It is also assumed that the plate is fully restrained along its long edges. This presumes that the panel stiffeners are much stiffer in bending than the sheet material, and that the panel is restrained in its own plane at its edges. Since the contribution of membrane stress is significant for the range of width to thickness ratios encountered in practice, finite deflections are taken into account in the analysis. C.T.C.

N66-16071*# Drexel Inst. of Tech., Philadelphia, Pa.
FLEXURAL WAVES IN ELASTIC CIRCULAR PLATES BY METHOD OF CHARACTERISTICS Final Report
Pei Chi Chou and Herbert Abraham Koenig Aug. 1965 58 p refs
(Grant NsG-270-63)
(NASA-CR-69703; DIT-160-6) CFSTI: HC $3.00/MF $0.50 CSCL 20K

The Uflyand–Mindlin plate equations in the form of two second order equations in terms of plate-displacements are analyzed by the method of characteristics for the case of an infinite plate with a circular hole. Procedures of numerical integration along the four characteristic directions including the technique of handling the propagation of discontinuities, are established. Numerical examples presented include the cases of transverse shear and radial bending moments applied at the hole. The numerical accuracy obtained is satisfactory for most of the cases. Author

N66-16079*# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.
THE DYNAMIC STIFFNESS OF A PNEUMATIC TIRE MODEL
Richard N. Dodge New York, SAE, [1965] 12 p refs Presented at SAE Mid-Year Meeting, Chicago, 17–21 May 1965
(Grant NsG-344)
(NASA-CR-69706) CFSTI: HC $1.00/MF $0.50 CSCL 20K

A rotating cylindrical shell model was utilized to approximate the dynamic response of a real pneumatic tire to a stationary point load. Analytical and experimental load deflection curves established reasonable correlations between such dynamic load deflection characteristics as predicted from the model and obtained experimentally. Static load deflection data taken with the experimental model loaded against a sharp edge, and with the model loaded against a roller indicate that the difference between the two load deflections is negligible. G.G.

N66-16097# National Aerospace Lab., Tokyo (Japan).
THEORETICAL STUDY OF TWO DIMENSIONAL PANEL FLUTTER AND PANEL DIVERGENCE IN SUBSONIC FLOW (II). COMPRESSIBLE FLOW CASE
Takao Ishii 1965 48 p ref In JAPANESE; ENGLISH summary
(NAL-TR-87) CFSTI: HC $2.00/MF $0.50

The aeroelastic instability of two dimensional pin-supported flat panels are studied by employing the exact linearized unsteady compressible flow theory. The generalized aerodynamic forces for a finite length panel are obtained by numerical integration with a computer at Mach number 0.6, 0.75 and 0.9 for the reduced frequency up to 1.8. As shown in an illustrative example of flutter and divergence boundaries of a flat aluminum panel at standard sea level atmosphere, the flutter boundary of a panel which is not subjected to axial loads and has no structural damping is more critical than the divergence boundary at some small range of Mach number thickness ratio combination. For a very thin panel which will be subjected first to divergence, a very simplified analysis has shown that the diverged panel may be prevented to go into flutter by the hoop tension due to the aerodynamic force acting on the surface of the diverged panel. Author

N66-16103# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LONGITUDINAL WAVE PROPAGATION IN AN ELASTIC-PLASTIC MEDIUM
D. T. Liu Sep. 1964 75 p refs
(Contract NOw-63-0050-c)
(LMSC-2-60-64-39; AD-623958) CFSTI: HC $3.00/MF $0.75

Thisreport is concerned mainly with plane-wave propagation of large amplitude stresses in a medium where motion transverse to the direction of wave propagation is presented. Both the partial differential equations governing the stress-wave propagation and the jump conditions across a shock discontinuity are developed using the basic principles of the conservation of mass, momentum, and energy. The criterion for a stable shock front is discussed, and the wave structure arising, when the criterion is no longer satisfied, is described. The constitutive law is discussed in some detail with particular emphasis on the elastic-plastic behavior of ductile solids. The finite difference method is developed for solving one-dimensional

shock wave propagation problems with initial and boundary conditions prescribed in terms of pressure or velocity; i.e., arbitrary pressure pulse input, free surface, or an interface between two different media. The operational FORTRAN computer program is described in some detail. Capabilities include predicting the shock wave response, possible bond separation, and spallation failure in a multilayered medium composed of up to four different materials. Sample calculations which serve to illustrate the difference between the hydrodynamic and elastic-plastic behavior of solids under shock compression are also included. Author (TAB)

N66-16154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE JPL HIGH-IMPACT PROGRAM—1965
J. L. Adams 1 Feb. 1966 33 p refs
(Contract NAS7-100)
(NASA-CR-69919; JPL-TR-32-844) CFSTI: HC $2.00/MF $0.50 CSCL 20K

This report summarizes the progress of the High-Impact Survival Program. Specific efforts underway include the investigation of mechanism elements and electronic packaging techniques under impact and the development of a ruggedized gas chromatograph, an impact-resistant 3-w solid-state S-band transmitter, impact-resistant flat-plate batteries, and ruggedized antennas. The development goal has remained the survival of a 10,000-g impact. Preimpact velocities up to 500 ft/sec are under consideration in order to cover possible Mars hard-landing situations. Test facilities have been developed in order to provide the necessary velocities. This report presents the status of these various efforts along with experimental results where pertinent. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N66-15248*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE INCIPIENCE OF FLOW OSCILLATIONS IN FORCED-FLOW SUBCOOLED BOILING
Frank A. Jeglic and Kwang-Tzu Yang (Notre Dame Univ.) [1965] 31 p refs Presented at the Heat Transfer and Fluid Mech. Inst., Los Angeles, 21-23 Jun. 1965
(NASA-TM-X-52081) CFSTI: HC $2.00/MF $0.50 CSCL 20M

A study was made of the onset of flow oscillations occurring when subcooled liquid undergoes phase change under forced flow conditions in a single tube boiler. Experimental data were obtained with electrically heated tubes of variable length over a range of fluid velocities, temperatures, and pressures. The experiments were conducted at system pressures of 3 to 100 psia with degassed, demineralized water flowing vertically upward through a heated test tube. Visual studies were made in which boiling was simulated by injecting steam or air through the porous wall of a tube. A mathematical model predicting the necessary criterion for the onset of oscillations was formulated on the basis of local rates of bubble growth and collapse. Good agreement was obtained between experimental and theoretical results. Author

N66-15273*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STEADY STATE AEROTHERMOCHEMISTRY FOR LIQUID BIPROPELLANT ROCKET MOTORS
Vito D. Agosta and S. Z. Burstein 1 Oct. 1964 40 p *Its* Rept.-64.3
(Contract NAS7-100)
(NASA-CR-68846) CFSTI: HC $2.00/MF $0.50 CSCL 21B

A model is proposed for the combustion of a bipropellant spray in a rocket motor. The model includes three subsystems: the fuel droplets, the oxidant droplets, and the combustion gases. The fuel droplet ballistics are determined by assuming a diffusion controlled evaporating droplet; thus it follows that fuel vaporization serves as the rate-controlling combustion process. A Knudsen-Langmuir kinetic model is assumed for the evaporation of the oxidant droplets. The combustion gases are generated by the combustion of the evaporated propellants at the local O/F ratio. The solution to this problem requires solving the coupled equations for heat, mass and momentum transfer for the fuel and oxidant droplets and vapors, and combustion gases, and also the chemical equilibrium equations for varying oxidant–fuel ratio. One-dimensional compressible gas dynamics is assumed. The results of this analysis give the mass distribution of oxidant and fuel vaporization, and subsequent combustion, along the axis of the rocket motor. Author

N66-15309*# National Bureau of Standards, Boulder Colo. Boulder Labs.
THERMODYNAMIC PROPERTIES OF LIQUID-VAPOR PARAHYDROGEN AND LIQUID-VAPOR OXYGEN
R. D. Mc Carty 17 Sep. 1965 65 p refs
(NASA Order R-45)
(NASA-CR-69250; NBS-8883) CFSTI: HC $3.00/MF $0.75 CSCL 20M

Entropy, enthalpy, and density values for specified mixtures of liquid and vapor parahydrogen and mixtures of liquid and vapor oxygen are presented for selected pressures. The properties for parahydrogen are based on saturation data previously reported from this laboratory. The properties of oxygen are based on saturation values obtained from an empirical equation of state fitted to a large body of P-V-T data, and from the experimental vapor pressure data. Author

N66-15312*# National Aeronautics and Space Administration, Washington, D. C.
STUDY METHOD AND PHYSICS OF HEAT EXCHANGE DURING VAPOR CONDENSATION [K VOPROSU O METODIKE ISSLEDOVANIYA I FIZIKE PROTSESSA TEPLOOTDACHI PRI KONDENSATSII PARA]
N. V. Zozulya Jan. 1966 14 p refs Transl. into ENGLISH from Tr. Inst. Teploenergetiki Akad. Nauk Ukr. SSR (Moscow), no. 14, 1958
(NASA-TT-F-369) CFSTI: HC $1.00/MF $0.50 CSCL 20M

The hydrodynamics of heat transfer during vapor condensation are studied, and results are given for quantitative and qualitative aspects of the process. The literature lacks information on design equations for film condensation in condensers with vertital tubes, etc., or film flow. The experimental setup and methods are described in detail. Advantages such as metallic observation mirrors are enumerated. Author

N66-15350*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ENTRY PERFORMANCE OF THE MERCURY SPACECRAFT HEAT SHIELD

R. Bryan Erb and Stephen Jacobs [1964] 82 p refs Presented at the AIAA Entry Tech. Conf., Heat Protection Session, Williamsburg, Hampton, Va., 12–14 Oct. 1964
(NASA-TM-X-57097) CFSTI: HC $3.00/MF $0.75 CSCL 20M

The flight performance of the Mercury Spacecraft ablative heat shield is summarized with respect to its conceptual development, thermal design and performance, and manufacturing and testing. A full-scale research and development shield was flight tested to provide a qualification of the ablative approach in general and the shingle-layup glass-reinforced phenolic system employed in particular. Thermal performance parameters were derived from this test which formed a basis for subsequent analysis and predictions. Flight-test results from the seven production shields flown, including the six that entered from orbit, are presented. Ground-test results and theoretical performance predictions were compared with the flight results and good correlation was found. Author

N66-15351*# Case Inst. of Tech., Cleveland, Ohio. Dept. of Mathematics.
ON ASSOCIATED RADIAL HEAT EXPANSIONS
Louis R. Bragg Sep. 1965 11 p refs
(Grant NsG-544)
(NASA-CR-69347; Rept.-217) CFSTI: HC $1.00/MF $0.50 CSCL 20M

It is shown that criterion has been previously given under which a classical solution u(r,t) of the radial heat equation

$$\frac{\delta}{\delta t}u(r,t) = \Delta_{\mu}u(r,t)$$

has valid series representations in terms of the set of radial heat polynomials

$$\{R^{\mu}_{j}(r,t)\}^{\infty}_{j=0}$$

and the set of associated radial functions

$$\{\bar{R}^{\mu}_{j}(r,t)\}^{\infty}_{j=0}$$

These sets are defined by functions involving the generalized Laguerre polynomial, and the coefficients in the expansion

$$u(r,t) = \sum_{j=0}^{\infty} a_j \bar{R}^{\mu}_{j}(r,t)$$

are defined by a complex integral. Relative to this, a note is given which shows a procedure for obtaining a series representation that often avoids the use of the expansion of u(r,t). C.T.C.

N66-15356*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SUMMARY OF BASE THERMAL ENVIRONMENT MEASUREMENTS ON THE SATURN I BLOCK I FLIGHT VEHICLES
Ira P. Jones, Jr. 3 Sep. 1965 158 p refs
(NASA-TM-X-53326) CFSTI: HC $5.00/MF $1.00 CSCL 20M

Base thermal environment measurements were made on all of the Saturn I Block I vehicles (SA-1 through SA-4). Total and radiation calorimeter measurements were made in the base region along with base gas temperatures and pressures. Details of the instrumentation and problems encountered in the data evaluation are discussed, and the data are compared from flight to flight on the basis of altitude. Some representative correlations of total and radiation heating, gas temperatures, and base pressures with small scale model tests are included. Flight heat transfer coefficients are calculated and compared with the model results. Author

N66-15372*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Aerospace Sciences Lab.
EMMISSIVITY COATINGS FOR LOW-TEMPERATURE SPACE RADIATORS Quarterly Progress Report No. 1, 1 Jul.–30 Sep. 1965
F. J. Smith and R. L. Olson [1965] 68 p refs
(Contract NAS3-7630)
(NASA-CR-54807) CFSTI: HC $3.00/MF $0.75 CSCL 20M

Progress is reported on a program to evaluate emissivity coatings for low temperature spacecraft radiators. A literature survey was completed and five candidate coatings were selected. These are zinc oxide–methyl silicone, titanium dioxide–silicone, zinc oxide–potassium silicate, aluminum silicate–potassium silicate, and zirconium silicate–potassium silicate. Substrates for the candidate materials were prepared and procurement of two sets of test specimens was initiated. These are the titanium dioxide–silicone and zirconium slicate–potassium silicate systems. In addition, a detailed test plan was prepared, the ultraviolet exposure facility was designed, test chambers were fabricated and checked out, and assembly of instrumentation and sources was started. R.N.A.

N66-15434*# Yale Univ., New Haven, Conn.
SOME CALCULATIONS PERTAINING TO THE FEASIBILITY OF MEASURING LUNAR HEAT FLOW Final Report
Sydney P. Clark, Jr. Sep. 1965 58 p refs
(Grant NsG-400)
(NASA-CR-69267) CFSTI: HC $3.00/MF $0.50 CSCL 20M

Study of the steady periodic temperatures in the lunar material will give usable information only if the surface material alone has an appreciable effect on the amplitude and phase of the thermal wave. Layering tends to reduce the amplitude of the fluctuation at a given depth. High-amplitude fluctuations near a place where the poorly conducting surface layer is missing do not penetrate far and pose no difficulty. Large perturbations of heat flow may be caused by irregularities in thickness of the surface layer, and a number of closely space measurements at a given landing site will be required to minimize this source of error. The "blanket" method of measuring lunar heat flow is not considered feasible because of the necessity of very closely matching the local albedo with the blanket, and because a blanket with properties such that an easily measured gradient free from periodic fluctuations can be set up by the lunar flux requires a prohibitively long time to come to thermal equilibrium. Conversely a blanket with a suitable time constant will yield only a small, seriously disturbed gradient that will be difficult to measure. Author

N66-15464# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany).
DETERMINATION OF TEMPERATURE PROFILES [BESTIMMUNG VON TEMPERATURPROFILEN]
W. Alvermann March 1965 29 p In GERMAN; ENGLISH summary
(DLR-FB-65-38) CFSTI: HC $2.00/MF $0.50

A method for measuring temperature profiles in gas flow is described, in which a thermocouple is lead through the cross section with constant speed. The deviations of the mean

values resulting from the to-and-fro motion of the thermocouple from the actual temperature pattern are theoretically determined. Further, the influence of the form of the temperature profile and the test conditions on the error is determined. Author

N66-15487*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER TO TURBULENT FLOW IN SMOOTH TUBES FOR THE REACTING N_2O_4-NO_2 SYSTEM
Alden F. Presler Washington, NASA, Jan. 1966 51 p refs (NASA-TN-D-3230) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Local turbulent heat-transfer coefficients were obtained experimentally for the dissociating system N_2O_4-NO_2 flowing through an electrically heated tube. For these experiments the tube length to diameter ratio was 40. Experimental conditions covered a seven-fold increase in the uniform heat flux up to 44000 Btu per hour per square foot and an eight-fold increase in mass average velocity up to 130000 pounds per hour per square foot. The maximum tube wall temperatures ranged from 359° to 572°K. Modified local heat-transfer coefficients, based on wall- to bulk-enthalpy differences, were correlated very well as a simple power of the mass average velocity. The local modified heat-transfer coefficients were correlated with a Dittus-Boelter-Colburn-type relation with all equilibrium transport and thermal properties evaluated on a mean temperature integral basis. The best curve through the data was about ten percent below the curve from constant property analyses. Author

N66-15576*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
SHOCK TUBE TECHNIQUES FOR STUDIES OF HIGH TEMPERATURE GAS RADIANCE
J. S. Gruszczynski, D. A. Rogers, and W. R. Warren Oct. 1965 42 p refs Presented at the 5th Shock Tube Symp., NOL, White Oak, Md., Apr. 1965
(Contracts NAS7-100; NASw-939; JPL-950297)
(NASA-CR-69429; R65SD33) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Techniques for measurement of equilibrium and nonequilibrium radiance of high temperature gases in an electrically driven shock tube are described. A method for the study of total radiation including vacuum UV contributions was developed and preliminary results are reported. Author

N66-15577*# General Electric Co., Philadelphia, Pa.
COATING SELECTION PROGRAM. PART II: PROGRAM DESCRIPTION AND USER'S MANUAL Final Report
25 Oct. 1965 196 p *Its* Doc.-65SD526, Rev. A
(Contract NASw-960)
(NASA-CR-69430) CFSTI: HC $5.00/MF $1.25 CSCL 20M

A computer program is described for selecting the optical coating pattern for the external surface of a spacecraft. Also described are the details of each subroutine and the details of input and output. The program is designed such that the temperatures are as close as possible to the midpoint of their preselected ranges, and are maintained passively by radiation and conduction. The selection technique is programmed for use on the GE 600 series, the IBM 7094, or any other computer that uses the standard IBM Fortran IV system. C.T.C.

N66-15589*# Delaware Univ., Newark.
EQUILIBRIUM TEMPERATURES OF MASS TRANSFER COOLED WALLS IN HIGH-SPEED FLOW OF AN ABSORBING-EMITTING GAS
J. D. Novotny, Y. Taitel, and J. P. Hartnett [1965] 30 p refs (Grant NsG-356)
(NASA-CR-69437) CFSTI: HC $2.00/MF $0.50 CSCL 20M

The Couette flow model was used to study radiation interaction effects in high-speed flow with mass transfer cooling. The case studied corresponds to the equilibrium or recovery wall temperature condition wherein the convection to the wall is balanced by the net radiation away from the wall. The recovery temperature and corresponding temperature profiles are determined for a wide range of the radiation interaction parameter, the mass transfer rate, and the optical thickness for representative values of the Eckert and Prandtl numbers. The results from the optically thin and thick approximations are also compared to those obtained from the more exact analysis. The relatively simple approach of superposition (i.e., adding the heat transfer for the pure radiation case to that for the pure convection case) is examined. This procedure not only predicts the equilibrium wall temperature with reasonable accuracy but also predicts the total heat transfer under conditions where the wall is at a temperature differing from the recovery condition. Author

N66-15593*# Delaware Univ., Newark.
MASS TRANSFER COOLING IN LAMINAR BOUNDARY LAYERS WITH HYDROGEN INJECTED INTO NITROGEN AND CARBON DIOXIDE STREAMS
C. S. Liu, S. P. Hartnett, and H. A. Simon [1965] 32 p refs (Grant NsG-356)
(NASA-CR-69443) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Two component, laminar boundary layers on a surface with zero pressure gradient, including the effects of variable properties, are studied. Hydrogen is injected from the stationary, porous flat plate into a free stream of nitrogen or carbon dioxide. The partial differential equations describing the velocity, concentration and temperature distributions are first transformed into total differential equations then into integral forms which can be solved numerically on an electronic digital computer. The two situations treated are the constant wall temperature and the adiabatic wall. The Mach numbers considered are 0, 4, 8 and 12, the free stream temperature t_∞ ranges from 218° K to 1110° K and the wall temperature to free stream temperature ratio $T_w = t_w/t_\infty$ ranges from 0.5 to 6. In addition to velocity, concentration and temperature profiles, the heat transfer and skin friction are also obtained. The final results are presented in simplified curves which are useful for design calculations. Author

N66-15599*# General Electric Co., Philadelphia, Pa.
COATING SELECTION PROGRAM. PART III: PROGRAM LISTING
25 Oct. 1965 55 p *Its* Doc.-65SD526, Rev. A
(Contract NASw-960)
(NASA-CR-69431) CFSTI: HC $3.00/MF $0.50 CSCL 20M

The program listing is given for a computer program which selects the optical coating pattern for the external surface of a spacecraft, such that the spacecraft temperatures are as close as possible to the midpoint of their preselected ranges. The temperature control is maintained passively by radiation and conduction, using no active control devices. The complete range in mission environments is considered in the optimization procedure. The selection technique was programmed for use on the GE 600 series, the IBM 7094, or any other computer that uses the standard IBM Fortran IV system. C.T.C.

N66-15630*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF MERCURY CONDENSING PRESSURE DROPS

M. Gutstein, R. T. Wainwright, and A. Koestel (Thompson Ramo Wooldridge) Washington, NASA, 1964 45 p refs Presented at the ASME Winter Ann. Meeting, New York, 29 Nov.–4 Dec. 1964

(NASA-TM-X-52034) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Experiments are described wherein the local static pressures were measured along tubes in which mercury vapor was flowing and condensing. Data were obtained at flow rates of 1.05 to 3 lb/min, at inlet pressures of 8 to 30 psia, and at condensing lengths of 4 to 8 ft. Both constant diameter and tapered tubes were employed in the study. A comparison of the two-phase frictional pressure drop with the Lockhart-Martinelli correlation showed significant deviations, particularly at low qualities. A relation between the frictional pressure drop and the Weber number, derived from fog-flow considerations, correlated the trend of the data over the full quality range. Experimental data obtained from the literature were utilized to further support this fog-flow correlation. Author

N66-15692# Lockheed Missiles and Space Co., Sunnyvale, Calif.

INFRARED ABSORPTION IN HEATED AIR FROM VIBRATION-ROTATION BANDS OF NITRIC OXIDE

D. R. Churchill and S. A. Hagstrom Nov. 1964 99 p refs (Contract Nonr-3368(00))

(LMSC-2-12-64-2; AD-623837) CFSTI: HC $3.00/MF $0.75

The contribution to the spectral absorption coefficient of heated air arising from the vibration-rotation bands of nitric oxide has been calculated with the aid of the SACHA digital computer programs. These band systems were theoretically reconstructed on a line-by-line basis using experimentally determined constants whenever these were available. A magnetic tape spectral atlas containing the reconstructed spectra was then employed by another computer program to calculate the average transmission of infrared radiation through a slab of heated NO whose occupation numbers were chosen to conform to the appropriate air case. Several parameters were varied in the calculation including the line half-width. Results of the calculations are contained in the form of graphs and tables. Computations were made for temperatures from 100° to 5000°K and for densities of normal atmospheric to 0.0001 normal. Frequencies covered were between 1200/cm and 10,000/cm (wavelength = 1 micron–8.3 micron). Author (TAB)

N66-15704# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.

RADIATION COUPLED WEDGE FLOW USING METHOD OF INTEGRAL RELATIONS

Martin C. Jischke Apr. 1965 42 p refs

(Grants AF-AFOSR-62-407; AF-AFOSR-614-64)

(MIT-AL-TR-112; AFOSR-65-1727; AD-624554) CFSTI: HC $2.00/MF $0.50

The radiation coupled supersonic flow past a wedge (or cone) is formulated using the first approximation of the method of integral relations. Solutions obtained for wedge flow of an optically thin, i.e., nonabsorbing, gas indicate a temperature decrease and density increase along the surface with a corresponding shock wave decay. Radiation effects on velocity and pressure are relatively small. Anamolous behavior of the transparent gas far downstream of the leading edge suggests a criterion for estimating the region of validity for the optically thin gas approximation. Author (TAB)

N66-15714# Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center.

DETERMINATION OF CRITICAL HEAT FLOWS DURING THE BOILING OF A HIGH-BOILING HEAT TRANSFER AGENT IN PIPES

L. S. Sterman and V. D. Mikhailov Oct. 1965 18 p refs Transl. into ENGLISH from Teploenerg. (Moscow), v. 10, 1963 p 82–87

(RSIC-485; AD-624801) CFSTI: HC $1.00/MF $0.50

Results are given of experiments on the determination of the values of critical heat flows during the flow of monoisopropyl diphenyl in pipes. It is shown that the known formulas cannot be used to determine these values during the surface boiling of monoisopropyl diphenyl and certain other organic liquids. Author (TAB)

N66-15773*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

BUBBLE FORMATION AND GROWTH. STUDY OF THE BOUNDARY CONDITIONS AT A LIQUID–VAPOR INTERFACE THROUGH IRREVERSIBLE THERMODYNAMICS Quarterly Progress Report, Jun.–Aug. 1965

Walter Bornhorst and Arthur Shavit Sep. 1965 21 p refs (Contract NAS8-20013)

(NASA-CR-69547) CFSTI: HC $2.00/MF $0.50 CSCL 20M

The object of this theoretical investigation is to obtain a set of equations which will predict the behavior of a fluid as it changes phase across a plane surface. Irreversible thermodynamics is employed to obtain the general rate equations and the results of kinetic theory are used to determine the order of magnitude of several of the constants which appear in the rate equations. The present analysis is limited to phase change problems which are linear, that is the change in the driving potentials is small as compared to their value on either side of the liquid-vapor interface. The equations which result from the analysis described above are applied to the condensation of a vapor on a plane liquid surface. From this example, the significance of the theory can be realized. Author

N66-15793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF A MAGNETIC FIELD ON THE CONDUCTION HEAT TRANSFER AT THE STAGNATION POINT OF A PARTIALLY IONIZED ARGON GAS

James F. Schmidt Washington, NASA, Feb. 1966 29 p refs (NASA-TN-D-3251) CFSTI: HC $2.00/MF $0.50 CSCL 01A

In a region of high electron-conduction heat flux (very high entry speeds) a magnetic field oriented parallel to the surface of the body can essentially eliminate the electron conduction heat flux and thereby reduce the total conduction heat transfer to the stagnation-point region. This conduction heat transfer is calculated for the following argon-gas stagnation-point flow conditions: pressure of 1.0, 0.1, 0.01, and 0.001 atmosphere at temperatures of 12 000°, 10 600°, 9500°, and 11 500° K, respectively. For the stagnation-point flow condition of 0.01 atmosphere and 11 500° K the maximum heat-transfer reduction (55 percent) is obtained for a magnetic-field strength of 12 000 gauss. The nonequilibrium boundary layer may have an even greater potential than the equilibrium boundary layer for a large heat-transfer reduction. Author

N66-15795# Aix-Marseilles Univ. (France). Inst. de Mécanique des Fluides de Marseilles.

EXPERIMENTAL STUDY AT M = 7 OF THE BOUNDARY LAYER INFLUENCE OF A FLAT PLATE ON THE TRANSFER OF HEAT TO THE SURFACE OF A CYLINDER INCIDENT TO THAT PLATE [ETUDE EXPERIMENTALE A M = 7 DE L'INFLUENCE DE LA COUCHE LIMITE D'UNE PLAQUE PLANE SUR LE TRANSFERT DE CHALEUR A LA SURFACE D'UN CYLINDRE POSE EN INCIDENCE SUR CETTE PLAQUE]

[1965] 90 p

(NT-2/7648-AY; ONERA-510.521) CFSTI: HC $3.00/MF $0.75

The influence of flat plate laminar and turbulent boundary layers on the convective heat transfer from the plate to a cylinder incident to the plate is studied for the case of hypersonic speeds; also studied is the influence of the boundary layers on the plate surface pressure and the pressure distribution and the density of heat transfer. The experimental set up, the working conditions, and the difficulties encountered are described; and results, diagrams, and schematics are included. Transl. by D.T.

N66-15803# Aerojet-General Corp., Sacramento, Calif. Solid Propellant Research Operations.

ON THE EXTINCTION OF OPPOSED-JET DIFFUSION FLAMES: A PHYSICAL CRITERION FOR EXTINCTION

R. F. Chaiken [1965] 32 p refs

(Contract AF 49(638)-851)

(AFOSR-65-1625; AD-623859) CFSTI: HC $2.00/MF $0.50

A physical criterion for the extinction of opposed-jet diffusion flames is presented. This criterion, when used in conjunction with the Spalding Theory of mixing in opposed-gas jets, enables the apparent flame strength to be related to (1) the effective maximum chemical reaction rate in the opposed-jet flame, and (2) the laminar flame speed of an equivalent premixed diffusion flame. The derived relationships differ somewhat from similar relationships given by Spalding's earlier theoretical treatment of the phenomena in the thin-flame approximation, but do yield quantitatively similar results when compared with experimental data reported for opposed-jet diffusion flames involving oxidation of simple hydrocarbons and ammonia. Author

N66-15832# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

RADIATION FROM THE LEM LANDING ROCKET EXHAUST GASES

T. Luzzi Jun. 1964 17 p refs

(RM-235; AD-473376)

An approximate analysis of the radiative flux from both the LEM descent rocket exhaust plume and the hot gases within the rocket nozzle on the landing leg pads is presented. Maximum values of the radiative flux are given; from these it can be seen that the radiation from the rocket exhaust does not seriously affect the landing pad heating load. Author (TAB)

N66-15867*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A PROGRAM FOR EQUILIBRIUM NORMAL SHOCK AND STAGNATION POINT SOLUTIONS FOR ARBITRARY GAS MIXTURES

Linwood B. Callis and Jane T. Kemper Washington, NASA, Feb. 1966 80 p refs

(NASA-TN-D-3215) CFSTI: HC $3.00/MF $0.75 CSCL 01A

A computer program written in FORTRAN IV language is presented which yields solutions for flow parameters in arbitrary equilibrium gas mixtures in the following situations: (1) behind a normal shock, (2) behind a reflected normal shock, (3) for in-flight stagnation conditions, and (4) for shock-tube stagnation conditions. Program output parameters are pressure, density, enthalpy, entropy, compressibility, temperature, and mole fractions of the included chemical species, which may number up to thirty. For traveling normal and reflected shocks, the flow velocity and reflected shock velocity are also presented as output. Equilibrium flow calculations are carried out by utilizing a free-energy minimization technique coupled with the steady-flow conservation equations and a modified Newton-Raphson iterative scheme. Chemistry up to second ionization is included. Input required for the program is described and required physical constants for computations involving 27 species of the argon, nitrogen, oxygen, and carbon genre are tabulated. Cases may be run in sequence and any or all of the aforementioned flow configurations may be included in a single case. Typical shock solutions are presented for argon free air and a model of the Mars atmosphere. Author

N66-15970# Naval Weapons Lab., Dahlgren, Va.

ATMOSPHERIC CONVECTION PRODUCED BY LOCAL HEATING OR COOLING OF A HORIZONTAL SURFACE

Hans J. Lugt and Ernst W. Schwiderski Oct. 1965 58 p refs

(NWL-1999; AD-624774) CFSTI: HC $2.00/MF $0.50

The paper is concerned with the study of steady laminar convection flows, which are produced by nonuniform axisymmetric heating or cooling of a horizontal surface in the presence of the Coriolis force. First order approximations are obtained by means of adjustable local boundary layer assumptions. Velocity, pressure, and temperature fields are computed for various Prandtl, Grashof, and Eckert numbers as well as for various Coriolis parameters. Since the radial inflow causes a cyclonic motion, and the radial outflow an anticyclonic motion, the local heating of a surface generates in the northern hemisphere a vortex which is counterclockwise in the lower part of the boundary layer and clockwise in the upper part. For a cooled surface the situation is reversed. Critical Grashof numbers and Coriolis parameters exist beyond which the flow field becomes unstable. The tendency toward instability is decreased by the Coriolis force. Author (TAB)

N66-16049*# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Mechanical Engineering.

SURFACE EFFECTS OF FLAME SPREADING OVER IGNITING COMPOSITE SOLID PROPELLANTS CONSTITUENTS

Fred A. Horowitz, Suh Yong Lee, and Robert F. Mc Alevy, III Jun. 1965 57 p refs

(Grant NGR-31-003-014)

(NASA-CR-69695; ME-RT-65005) CFSTI: HC $3.00/MF $0.50 CSCL 21B

An experimental investigation was made of the mechanism by which a flame spreads over the surface of igniting composite solid propellant constituents. The velocity of flame spreading over the surface of polystyrene and polymethylmethacrylate in quiescent, oxidizing gas environments, and over the surface of ammonium perchlorate in a quiescent, fuel-gas environment was measured as a function of pressure level, chemical nature and reactivity of the surrounding environment, and specimen surface conditions. The effect of surface geometry was studied by employing test specimens of loosely packed beads, hydraulically pressed beads, chemically bonded beads, and smooth

surfaced solids. These specimens were prepared and mounted in a relatively large vacuum tight chamber, and following ignition by means of an electrically heated wire, the velocity of flame spreading was measured cinematographically. It was found that velocities vary directly with pressure level, and that when surface geometry factors are introduced there is a marked increase in the velocity and a departure from theoretical predictions. C.T.C.

N66-16072*# Southern Methodist Univ., Dallas, Tex.
HEAT TRANSFER ACROSS SURFACES IN CONTACT: PRACTICAL EFFECTS OF TRANSIENT TEMPERATURE AND PRESSURE ENVIRONMENTS Semiannual Report, Apr. 1–Oct. 1, 1965
Harold A. Blum [1965] 42 p refs
(Grant NsG-711)
(NASA-CR-69696) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Both analytical and numerical theoretical studies have continued on the problem of one-dimensional heat flow across surfaces in contact, where the source temperature was suddenly imposed upon the system which had been at a uniform initial temperature. Temperature–time position information was obtained for various combinations of materials, lengths, and contact resistances in order to estimate the time to approach a new steady state value. Preliminary studies with an explicit numerical method for handling a two-dimensional heat transfer problem involving contacts indicate that the machine time, as contrasted to the one-dimensional case, is greater by a factor of about sixty. Experimental work has consisted of designing and building a system to study the transient response of cylinders in contact, when subjected to changes in thermal environment, ambient pressure, and contact pressure. The results obtained are discussed from the viewpoint of applying these findings to future research, and several changes or modifications in hardware and procedures are proposed. M.G.J.

N66-16162*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
USE OF FUSIBLE TEMPERATURE INDICATORS FOR OBTAINING QUANTITATIVE AERODYNAMIC HEAT-TRANSFER DATA
Robert A. Jones and James L. Hunt Feb. 1966 30 p refs
(NASA-TR-R-230) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Some of the methods used for obtaining quantitative aerodynamic heat-transfer data by means of temperature-sensitive coatings are described and discussed. A method whereby data can be obtained on arbitrary shapes without the use of a reference body has been developed. In this method, the heat-transfer coefficients depend only upon the thermal properties of the model material and the time required for a visible phase change of a fusible temperature indicator which is applied to the model as a thin surface coating. The phase change is recorded by motion-picture photography, and charts are given which relate the time required for the phase change to occur to the heat-transfer coefficient. Data obtained by this method are compared with aerodynamic theory and with data obtained by the conventional thermocouple-calorimeter technique. Several configurations were tested in the Langley Mach 8 variable-density tunnel. The results indicate that this method can be very useful and that accurate data can be obtained. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N66-15270# Joint Publications Research Service, Washington, D. C.
NEWS OF SOVIET CYBERNETICS
N. M. Potiyevskiy 29 Dec. 1965 17 p Transl. into ENGLISH from Russian periodicals
(JPRS-33520; TT-65-34094) CFSTI: $1.00

CONTENTS:
1. COMPUTERS GIVE THE ANSWER N. M. Potiyevskiy, p 1–3 (See N66-15271 06-08)
2. CYBERNETICS AT THE LESSON A. Bezdenezhnykh p 4–5
3. CYBERNETICS IN PLANT-GROWING N. Bolgarov p 6–8 (See N66-15272 06-04)
4. ELECTRONIC ASSISTANTS E. Mikhnevich p 9–11
5. SCIENTIFIC ORGANIZATION OF LABOR—CREATOR AND COMRADE A. Obukhov p 12–15

N66-15301# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLANT LABORATORY Selected Articles
28 Sep. 1965 25 p refs Transl. into ENGLISH from Zavodsk. Lab. (Moscow), v. 30, no. 6, 1964 p 675, 725–726, 733–738 (FTD-TT-65-694/1+2; AD-622453) CFSTI: HC $1.00/MF $0.50

CONTENTS:
1. ANALYSIS OF PRODUCTS OF COMBUSTION OF METHANE–AIR MIXTURE BY THE GAS CHROMATOGRAPHY METHOD V. N. Abramov and V. I. Fisak 2 p (See N66-15302 06-06)
2. QUANTITATIVE X-RAY OF CARBIDES AND NITRIDES OF TITANIUM, ZIRCONIUM AND HAFNIUM Yu. V. Levinskii 4 p ref (See N66-15303 06-06)
3. METHOD OF ESTIMATION OF FATIGUE STRENGTH WHEN THE PROCESS OF REPEATED LOADING IS DIVIDED INTO TWO STAGES R. D. Vagapov 15 p refs (See N66-15304 06-32)

N66-15325*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LIFE IN SPACE AND HUMANITY ON THE EARTH A Joint Review of Five Books
Su-shu Huang [1964] 19 p refs Submitted for Publication
(NASA-TM-X-56136) CFSTI: HC $1.00/MF $0.50 CSCL 05F

A review of five books is presented, covering the following subject areas: (1) the astronomer's contribution to humanity; (2) emergence of intelligence—a biological problem; (3) interstellar communication; and (4) supercivilization and the problem of man's future. The books reviewed include a variety of topics, such as galaxies, stars, educational systems, and international cooperation; a description of cosmic chemistry and the possibility that life may appear elsewhere because of the large number of stars present in the universe; astronomical

problems and reflections on planets, including Venus, Jupiter, Mars, and the Moon; and a description of the outlook of life in other worlds as seen, mainly, by physical scientists and engineers. R.R.D.

N66-15377*# Northrop Space Labs., Hawthorne, Calif.
TECHNOLOGY UTILIZATION REVIEW AND ANALYSIS, VOLUME II Final Report, 28 Feb.–31 Aug. 1964
L. F. Bernbach and D. E. Kaufman Sep. 1964 41 p
(Contract NAS7-277)
(NASA-CR-69269; NSL-64-192, Vol. I) CFSTI: HC $2.00/MF $0.50 CSCL 13H

The work performed on the following tasks is reported: (1) to determine what new technology has been developed by the Ranger Block III program and to what extent these technological advances may be of use to the scientific and industrial communities; (2) to analyze similarly engineering and technical reports; (3) to prepare Flash Sheets disseminating information on invention disclosures; and (4) to determine the most meaningful and promising technical innovations resulting from the space program and the best methods of presenting these subjects. Also, significant events or accomplishments considered of interest are reported. The methodologies employed are described, followed by a discussion on some technology utilization philosophies and concepts developed in the performances of required tasks. Conclusions and recommendations are included. E.E.B.

N66-15402# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
OPERATIONS RESEARCH V, TITLE INDEX
1964 55 p refs
(TDCK-40683) CFSTI: HC $3.00/MF $0.50

Titles of publications and reports announced in the abstract bulletin, *Operations Research*, are presented. The index is divided into sections on *Theory*, which include queuing, programming, game, information, and inventory theories, and the theory of the optimum distribution of effort; *Applications*, which covers management, military applications, quality control, accountancy, and medical problems; *Book Reviews*; and *News*. M.G.J.

N66-15414# Royal Aircraft Establishment, Farnborough (England).
PNEUMATIC CONVEYING OF GRANULATED MATERIALS
Sep. 1965 22 p Transl. into ENGLISH from GERMAN
(RAE-LIB-TRANS-1125) CFSTI: HC $3.00/MF $0.50

A method of calculating the design of practical systems for the pneumatic transport of granulated materials is described. Given the nature of material, the required throughput and the layout of the ducting system, the calculations determine duct size, airflow rate, pressure drop and total power requirement. Both pressure and suction conveyors are considered, as also are pneumatic shoots. Author

N66-15741# Congress. Senate. Committee on Aeronautical and Space Sciences.
INTERNATIONAL COOPERATION AND ORGANIZATION FOR OUTER SPACE
Washington, GPO, 1965 624 p refs Staff rept. prepared for the Comm. on Aeron. and Space Sci., 89th Congr., 1st Sess. *Its* Doc.-56
GPO: $2.00

Organizations with space and space-related programs were surveyed, and the structure and functioning of these institutions as described. The report analyzes the impact of the frontier of outer space upon United States foreign relations; bilateral and multilateral relations among nations; the relationship between outer space and arms control; international economic, technical, and scientific developments; and policies and programs of the United Nations and its specialized agencies. M.G.J.

N66-15783# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON THE INDUSTRIAL SCIENCES [BEDRIJFSWETENSCHAPPEN LITERATUUROVERZICHT]
13 Sep. 1965 29 p refs In DUTCH and ENGLISH *Its* Vol. 4, No. EM-86
CFSTI: HC $2.00/MF $0.50

An annotated bibliography on management systems, financial control, economizing, cost estimation, logistics, psychology, sociology and personnel training techniques in military, industrial, and research facilities is presented. M.R.W.

N66-15837# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON CIVILIAN TRANSPORT [INTERN-TRANSPORT LITERATUUROVERZICHT]
Jul. 1965 30 p refs In DUTCH *Its* No. 50
CFSTI: HC $2.00/MF $0.50

Abstracts are presented covering the transportation of goods, warehouse storage, loading and unloading methods, packing, safety, and transportation aids. E.E.B.

N66-15872# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON SHIPBUILDING AND NAVIGATION [LITERATUUROVERZICHT SCHEEPSBOUW EN SCHEEPVAARTTECHNIEK]
15 Oct. 1965 30 p refs In DUTCH, GERMAN, FRENCH, and ENGLISH *Its* Vol. 10, No. S-175
CFSTI: HC $2.00/MF $0.50

A compilation of abstracts is presented of literature pertaining to shipbuilding and navigation technology. Included are such areas as ship models, resistance and propulsion, strength and vibrations, design and construction, and upkeep and repair. C.T.C.

N66-16157*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
1965 PUBLICATIONS BY MATERIALS DIVISION
13 Jan. 1966 25 p refs
(NASA-TM-X-53378) CFSTI: HC $1.00/MF $0.50 CSCL 05B

A compilation of annotated abstracts of NASA technical memorandums and MSFC internal notes written by personnel of the Materials Division and released during 1965 is presented. Publication topics covered include material studies in propellants; bonded composite materials; engineering materials; alloys; elastomers; organic materials; explosives; lubricants; and heat carrying materials. L.S.

Collections of NASA Documents

NASA is depositing its technical documents and bibliographic tools in eleven Federal Regional Technical Report Centers. Each Center, located in the organizations listed below, is prepared to furnish the general public such services as personal reference, inter-library loans, photocopy service, and assistance in obtaining retention copies of NASA documents.

California: University of California, Berkeley
Colorado: University of Colorado Libraries, Boulder
District of Columbia: Library of Congress
Georgia: Georgia Institute of Technology, Atlanta
Illinois: The John Crerar Library, Chicago
Massachusetts: MIT, Cambridge
Missouri: Linda Hall Library, Kansas City
New York: Columbia University, New York
Pennsylvania: Carnegie Library of Pittsburgh
Texas: Southern Methodist University, Dallas
Washington: University of Washington Library, Seattle

In addition, NASA publications are currently being forwarded to the public libraries in the cities listed below:

Alabama: Birmingham
Alaska: Anchorage
Arizona: Phoenix
Arkansas: Little Rock
California: Los Angeles, Oakland, San Diego, San Francisco
Colorado: Denver
Connecticut: Hartford, Bridgeport
Delaware: Wilmington
Florida: Miami
Louisiana: New Orleans
Maryland: Enoch Pratt Free Library, Baltimore
Massachusetts: Boston
Michigan: Detroit
Minnesota: St. Paul
Missouri: Kansas City, St. Louis
New Jersey: Trenton
New York: New York State Library, Brooklyn, Buffalo, Rochester
North Carolina: Charlotte
Ohio: Cleveland, Cincinnati, Dayton, Toledo
Oklahoma: Oklahoma City
Pennsylvania: Pittsburgh
Tennessee: Memphis
Texas: Fort Worth, San Antonio
Washington: Seattle
Wisconsin: Milwaukee

An extensive collection of NASA and NASA-sponsored scientific and technical publications available to the public for reference purposes is maintained at the Technical Information Service, American Institute of Aeronautics and Astronautics, 750 Third Avenue, New York, New York, 10017.

"The aeronautical and space activities of the United States shall be conducted so as to contribute . . . to the expansion of human knowledge of phenomena in the atmosphere and space. The Administration shall provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."

—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

NASA SCIENTIFIC AND TECHNICAL PUBLICATIONS

TECHNICAL REPORTS: Scientific and technical information considered important, complete, and a lasting contribution to existing knowledge.

TECHNICAL NOTES: Information less broad in scope but nevertheless of importance as a contribution to existing knowledge.

TECHNICAL MEMORANDUMS: Information receiving limited distribution because of preliminary data, security classification, or other reasons.

CONTRACTOR REPORTS: Technical information generated in connection with a NASA contract or grant and released under NASA auspices.

TECHNICAL TRANSLATIONS: Information published in a foreign language considered to merit NASA distribution in English.

SPECIAL PUBLICATIONS: Information derived from or of value to NASA activities. Publications include conference proceedings, monographs, data compilations, handbooks, sourcebooks, and special bibliographies.

TECHNOLOGY UTILIZATION PUBLICATIONS: Information on technology used by NASA that may be of particular interest in commercial and other nonaerospace applications. Publications include Tech Briefs; Technology Utilization Reports and Notes; and Technology Surveys.

Details on the availability of these publications may be obtained from:

SCIENTIFIC AND TECHNICAL INFORMATION DIVISION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington, D.C. 20546